

TECHNICAL REPORT NO. 318

COPPERHEAD OPERATIONAL PERFORMANCE EVALUATION (COPE):

COMPUTER PROGRAM USER AND ANALYST MANUAL

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RICHARD S. SANDMEYER

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U. S. ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY ABERDEEN PROVING GROUND, MARYLAND

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PREFACE

This report documents the COPE methodology and computer programs.

Various sections of this report are aimed at different audiences:

Chapter 1 is an introduction to COPE and to this report.

Chapters 2 and 3 are intended for the analyst who is concerned with the modeling methodology and assumptions.

Chapters 4, 5, 6, 7, 14, 15, and 16 are aimed at the user who wants to use the COPE model and its preprocessors in production runs, but who is not interested in programming details.

Chapters 8, 9, 10, 11, 12, and 13 are intended for the programmer who wants a thorough understanding of the COPE computer code in order to implement it on other machines or simply to make changes to it.

The first four appendixes (A, B, C, and D) include program listings and sample cases. The sample cases are cumulative in the sense that the three PAM sample input sets should be run using respectively the three PAM sample runstreams before running the PREPMS program. The sample PREPMS case should then be run using the TAPE 11 created by the PAM runs (this will result in the output of Appendix C). Finally, the COPE sample case should be run using the TAPE 11 created by PAM and PREPMS (this should result in the output of Appendix D). Running these sample cases and comparing the results with those in the appendixes provide a check for correct implementation of COPE and its preprocessors on other machines.

If discrepancies are found in this publication or the associated software, please send notice to:

Director
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-GS (Mr. R. Sandmeyer)
Aberdeen Proving Ground, MD 21005

Suggestions for improvements to this report or the associated programs may also be sent to the above address.

In addition, requests for magnetic tape copies of the COPE programs and related files should be sent to the same address along with the appropriate paperwork for such requests.

This report may be updated by the issuing of revised pages. The frequency of such updates will, of course, depend on the number of errors requiring correction, the changes made in the model, and the demand for the report. Those desiring to maintain the latest versions of the report and the programs should be certain that they are on the COPE distribution list to be maintained by AMSAA.

NOTE ON CLASSIFICATION

This report is unclassified, however, when the COPE model is used for actual production runs, it requires some classified inputs. The inputs used in the sample cases (see Appendixes) are correct data except for false values which have been inserted in place of those data whose correct values are classified.

In addition, comment cards with the characters "CSEC" in columns 1-4 point out places in the program code where fictitious constants have been substituted to replace classified values in the listings of PAM and COPE (Listings A-1 and D-1).

The following data are classified (at the time of publication of this report) when correct values are used and identified as such:

In the PAM program: ETH, THEMH, and DISMH are classified by Reference 1 below. ED is classified by Reference 2.

In PREPMS and COPE programs, the values of PE, RNGTTF, and PKTBL, as well as the true seeker sensitivity value, are all classified by Reference 1.

²Security Classification Guide, <u>Ground Laser Designators</u>, dated 16 June 1978.

¹ Security Classification Guide, <u>Projectile</u>, 155mm, Cannon Launched, Guided, XM712, (CLGP), dated 24 July 1979.

ACKNOWLEDGEMENTS

The COPE model was developed by the Support Weapons Analysis Branch (SWAB) of the Ground Warfare Division (GWD) of the US Army Materiel Systems Analysis Activity (AMSAA).

The requirement to create such a model came from David Hardison, Deputy Under Secretary of the Army for Operations Research (DUSA-OR). A preliminary model proposal was put forward by Herbert Fallin of the Office of DUSA-OR.

When AMSAA received the requirement and proposed model, a team of four analysts of the System Evaluation Section of SWAB was established to develop the model, oversee the collection of data, and, as it turned out, participate in the COPPERHEAD COEA by doing production runs and writing up the results. This team consisted of the section chief, Richard Scungio, who served as team leader and overall coordinator, Julian Chernick, Michael Starks, and the author of the present report, Richard Sandmeyer. Much of the design of the COPE model was accomplished by discussion within the team and individual credit cannot easily be assigned. However, COPE drew heavily on the probability of engagement work done previously by Mr. Chernick and Mr. Starks (see bibliography) including the modeling of weather; the PAM program written by Michael Starks was a derivative of a program used in that earlier work. Mr. Sandmeyer converted the conceptual COPE model into a working computer program (COPE) and also wrote the remaining two programs of this report (PREPMS and PRBLOS).

This report is, of course, concerned with the COPE model and its implementation as a computer program, but a word of appreciation to those who helped gather data for COPE is appropriate here even though this report does not deal with the data collection process (for the data sources used, see COPPERHEAD COEA in bibliography). Data for use in COPE was gathered by David Barnhart, Diana Frederick, Annie Young, and Edward Stauch (all of SWAB). In addition, David Kilminster of SWAB had previously assisted Mr. Chernick and Mr. Starks in obtaining and using weather data. Charles Cairns of AMSAA supplied LDWSS probability of hit numbers and MAJ Charles Williams of FT Sill, OK, provided advice and served as liaison between AMSAA and FT Sill. The SMOKE data was obtained from Sid Gerard (then of AMSAA, now of PM, SMOKE).

Special thanks is given to Mrs. Robin DeFranks, who edited and typed this lengthy report. Thanks also to Mary Webb of SWAB who typed the text in the flow charts of Chapter 11.

CHAPTER 1

INTRODUCTION

1.1 COPE Background.

Traditionally the item level performance of a weapon system has been expressed in terms of the firepower characteristics of the weapon. The weapon characteristics normally included in the computation of firepower were range, accuracy, lethality, and rate-of-fire. With the introduction of more sophisticated weapons, an awareness of the need to include additional factors in the assessment of a weapon's performance has emerged at both the decision and R&D levels. These additional factors have collectively been referred to as the "Battlefield Environment" and include natural phenomena as well as conditions imposed on the system by friendly and enemy forces.

The need for quantifying a weapon system's performance within the battlefield environment recently became most critical with the development of the 155mm XM712 COPPERHEAD artillery projectile. To study its potentially degraded performance under some battlefield environments, AMSAA developed a computer model which is known by the acronym COPE (COPPERHEAD Operational Performance Evaluation).

In addition to being a model for assessing the performance of a weapon system, the model and the manner of generating the input requirements constitute a novel approach to the evaluation of weapon systems. This approach results in a manner of assessing the performance of most weapon systems and potentially can quantitatively produce insight into the performance of one or more weapon systems which previously could only be treated subjectively.

This report describes the COPE model as currently used at AMSAA for the assessment of COPPERHEAD. AMSAA has modified the computer code to obtain models that analyze the performance of other weapon systems within the context of a COPE type "operational performance" analysis. The term COPE itself has now come to have two meanings: (1) "Combat Operational Performance Evaluation" which is the generic name for all of the derivative models of the original COPPERHEAD version and (2) "COPPERHEAD Operational Performance Evaluation" which is the first model in this family of "Operational Performance" models and is the one described in this report.

The models in the COPE family include:

- (1) COPPERHEAD Operational Performance Evaluation (COPE) used to evaluate the XM712 COPPERHEAD artillery round,
- (2) <u>Tank Performance Evaluator (TAPE)</u> used as part of the XMI tank evaluation,
- (3) TOW Operational Performance Evaluator (TOPE) used to evaluate the TOW anti-tank missile,

- (4) <u>SADARM Operational Performance Evaluator (SOPE)</u> used to evaluate the proposed SADARM artillery round,
- (5) <u>Top Attack Evaluation Model (TAEM)</u> used to evaluate candidates in the Top Attack Study,
- (6) Ground Launched HELLFIRE Operational Performance Evaluation (GLHOPE) used to evaluate ground launched HELLFIRE,
- (7) <u>RPVCOPE</u> used to evaluate COPPERHEAD when designation was performed by an RPV, and,
- (8) <u>HELLFIRE Operational Performance Evaluation (HOPE)</u> used to evaluate HELLFIRE launched from helicopters.

The input requirements for these models range from moderate to massive. The TAPE and TOPE models for example require no preprocessors and take less input than the COPPERHEAD version. The TAEM program, on the other hand, requires as input results generated by the very costly, long running, TGSM (Terminally Guided Submunition Model) program.

This report is concerned only with the COPE model (in all remaining sections of this report, COPE shall have its second, narrower meaning: "COPPERHEAD Operational Performance Evaluation"); however, much of what is discussed applies to the other models in the family. Any of the models of the COPE family can be obtained from AMSAA, though at the present time only the COPPERHEAD and tank versions have been extensively documented.

1.2 Overview of COPE Computer Programs.

There are actually four computer programs used in the COPPERHEAD Operational Performance Evaluation. They are:

- (1) The main COPE program (formerly called SLATCH for Simple Look at the COPPERHEAD) descended from the original proposal put forward by DUSA-OR.
- (2) The PAM (Probability of Seeker Acquisition and Round Maneuver) model used to create the probability of engagement tables used as input to the main COPE program. This model is described and documented more thoroughly in a forthcoming AMSAA technical report.
- (3) The PREPMS (<u>Preprocessor Mass Storage</u>) program that is used to create and modify the word addressable mass storage file used as the COPE "data base".
- (4) The PRBLOS (<u>Probability of Line-of-Sight</u>) model used to obtain the probability of having line-of-sight for the terminal phase of the COPPERHEAD trajectory.

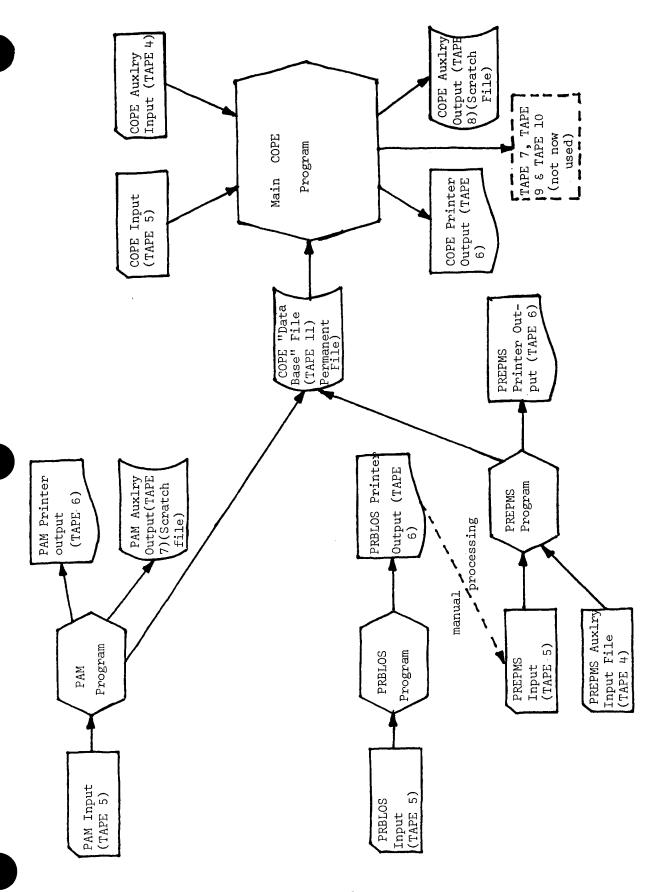


FIGURE 1-1 COPE And Its Preprocessors

All four of these programs are documented in this report, though the PAM model is covered in much less detail than the other three since a more detailed treatment of it will be published in a separate report.

The relationships among the four programs and the word addressable "data base" file are shown in Figure 1-1.

The major data sets (called "data blocks" later in this report) are put on the data base by PAM and PREPMS. Then when one wishes to run COPE, it is necessary only to submit a string of simple input commands describing the cases to be run. For example, when running a case using December weather for 0600 (6 a.m.), one need merely submit a card: WEATHER, DECEMBER, 0600 rather than read in thirty or forty cards filled with the appropriate weather data. This arrangement makes it extremely simple to run many cases of COPE with relatively few input cards once the data base file has been created.

In the event that one wishes to run cases that use a data set not on the data base file, there is a "temporary" option that allows one to read the data into COPE directly; however, if one intends to run multiple cases with such data, it will be easier in the long run to read it onto the permanent data base file once using the PREPMS program and then "call it up" for use as necessary in COPE by submitting the appropriate single card command.

All four programs are written in CDC FORTRAN Extended Version 4.

CHAPTER 2

DESCRIPTION OF COPPERHEAD MISSION MODELING

2.1 Application Area of Simulation.

The main COPE program is a simulation of a COPPERHEAD fire mission under battlefield conditions. It takes into account such degrading effects on designator, fire direction center (FDC), artillery battery, and COPPERHEAD round performance as meteorological conditions, terrain shielding, smoke, dust, enemy artillery preparatory fires, enemy direct fire against the designator, communication failures, and target location error as well as numerous factors that affect COPPERHEAD's ability to engage and hit a target.

The main COPE program was designed to evaluate the operational performance of the overall COPPERHEAD system under battle-field conditions.

The output of the program enables one to see which factors contribute most to the degrading of COPPERHEAD system performance and which are, therefore, areas in which performance improvement efforts should be concentrated.

In addition, by varying the input value(s) associated with a particular factor and then studying the results, one can perform the customary sensitivity analysis. A series of such analyses can be expected to show that changes (within realistic limits) in some factors have little effect on overall system operational performance whereas changes in other factors will result in major performance improvement or degradation.

By comparing those factors to which system operational effectiveness is most sensitive with those factors over which system designers and tacticians have some control, one can determine what, if any, design changes or employment doctrine changes might be made to improve overall COPPERHEAD system operational performance. This comparison and analysis, of course, is done outside the COPE program, but the resulting modified COPPERHEAD system and employment doctrine might then be evaluated in the COPE model or a descendent of it.

Finally, several derivative models have been developed from an earlier COPE program (SLATCH version 3.2) and are in use for evaluating tanks, TOW, and Hellfire under battlefield conditions. These models allow limited but informative comparisons of the operational performance of the different weapon systems.

2.2 Description of Model.

2.2.1. Outline of COPPERHEAD Mission. The heart of the main COPE program is the Monte Carlo simulation of a potential COPPERHEAD fire mission. This simulation consists of a series of steps that would occur in an actual COPPERHEAD fire mission. For a successful mission, these steps start with the unmasking from terrain shielding of a target and end with the killing of a target by COPPERHEAD. For an unsuccessful mission, the steps end before the target is killed.

The steps are grouped into three series bounded by four major events. The following outline gives the four major events as well as the steps (or tests) that must be passed to reach the next major event. All steps and events occur in the order listed.

This describes the tests when the so-called "shooting gallery" line-of-sight model is used. Following the list is a description of the modifications required when the "random occurrence" line-of-sight model is used.

- Event 1. A target (one or more target vehicles) unmasks (i.e., enters a region within line-of-sight of the designator operator's position). This is termed an "occasion" and begins the simulation of the potential COPPERHEAD mission.
- Test 1: Has the designator operator survived enemy preparatory artillery fires up to the present time?
- Test 2: Is the target within the meteorological visibility range limit of the designator operator for the present weather conditions?
- Test 3: Is the target within the designation range of the laser designator system being played?
- Test 4: Did the designator operator detect/acquire the tdrget before it again became masked by terrain?
- Test 5: Is the line-of-sight from designator-to-target sufficiently free of smoke that the designator operator can see and designate the target?
- Test 6: Is the line-of-sight from designator-to-target sufficiently free from dust for the designator operator (D.O.) to see and designate the target?
- Test 7: Is the target sufficiently far away from the designator operator that he will stay and designate rather than "bail-out?"

- Event 2: The designator operator has acquired a target and decides to engage it (i.e., call for COPPERHEAD fire against it). This is termed an "attemped engagement."
- Test 8: Is the designator operator able to communicate with the fire direction center (FDC)?
- Test 9: Does the message which the designator operator sends to the fire direction center contain the correct information and does the FDC interpret it correctly?
- Test 10: Is the target still (after time has been spent on communication and preparing to fire the mission) sufficiently far away that the designator operator will stay and designate rather than "bail-out?"
- Test 11: Does the designator operator still have line-of-sight to the target?
- If tests 8 through 11 are all passed, then conditions are such that a COPPERHEAD fire mission occurs. This leads to:
 - Event 3: The battery is ready to fire and the designator is ready to designate. A COPPERHEAD round is fired. This is termed a "shot".
 - Test 12: Does the designator operator still have lineof-sight to the target during the final critical time interval of the COPPERHEAD trajectory?
 - Test 13: Has the designator operator been warned to begin lasing the target or has he seen the first COPPERHEAD round of this fire mission already impact?
 - Test 14: Does the designator survive direct fire from the target being designated and is the line-of-sight to the target unobscured by direct fire rounds landing in front of the designator?
 - Test 15: Is the COPPERHEAD round just fired reliable?
 - Test 16: Is the line-of-sight from the designator operator to the target vehicle unobscured by small terrain features?
 - Test 17: Does the round come sufficiently close to the target for the seeker to receive enough reflected laser energy to engage the target and is the target within the maneuver footprint of the COPPERHEAD?

Test 18: Does the COPPERHEAD round hit the target?

Test 19: Does the COPPERHEAD round kill the target?

If tests 12 through 19 are all passed, then we have:

Event 4: The target vehicle is killed. This is termed a "kill."

If more COPPERHEAD rounds are to be fired for this mission, the model time is moved ahead to account for the time between rounds, and the model resumes at Event 3 for the next COPPERHEAD round.

To model the "random occurrence" line-of-sight case, tests 4 and 11 are not made and test 12 uses a different assumption.

The two ways of handling the line-of-sight problem are called the "shooting gallery" method and the "random occurrence" method.

The "shooting gallery" method assumes that the entire COPPERHEAD mission must be completed during the time interval starting with the first target vehicle entering line-of-sight segment and ending with the last vehicle of the target leaving that same line-of-sight segment (see Figure 2-1).

The "random occurrence" method on the other hand assumes that target vehicles are passing in and out of view. Instead of assuming that all rounds fired after the last target vehicle leaves the line-of-sight segment in which it was acquired are wasted as in the "shooting gallery" technique, the "random occurrence" method does not check loss of line-of-sight until the last critical seconds of the COPPERHEAD trajectory and even then the check allows for the possibility that a target may have left the first line-of-sight segment but entered a second (or subsequent) line-of-sight segment where COPPERHEAD can be used. The "random occurrence" line-of-sight model, then merely checks whether there is at least one unkilled target vehicle that will be within line-of-sight of the designator for the final critical seconds of the COPPERHEAD trajectory (see Figure 2-2).

Now each step (test) in the model is explained in detail:

2.2.2 Preparatory Fires. The first test encountered by a potential COPPERHEAD mission is for designator operator survivability of preparatory fire. A probability that the designator operator is killed by enemy preparatory artillery is input (either explicitly or by default) and for each replication (i.e., each sample potential COPPERHEAD mission) of the given case, a uniformly distributed (pseudo-) random number is drawn. If that random number is less than the input probability that the designator operator is killed by enemy preparatory artillery fire, then the potential COPPERHEAD

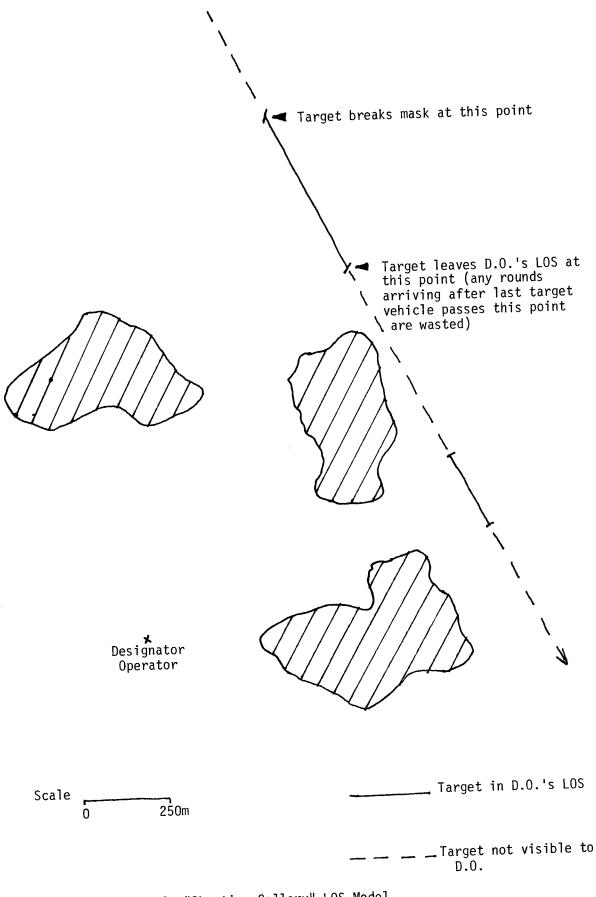


FIGURE 2-1 "Shooting Gallery" LOS Model

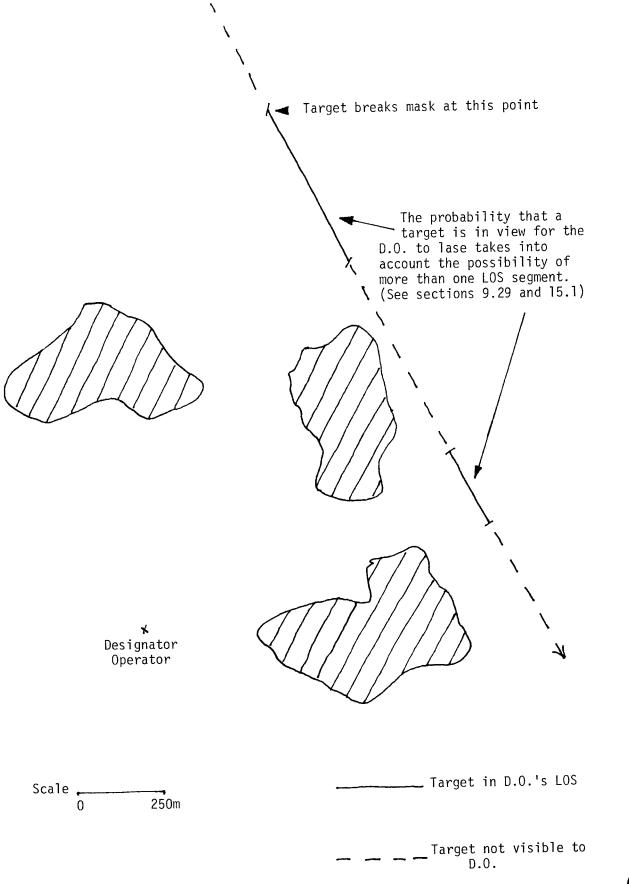


FIGURE 2-2 "Random Occurrence" LOS Model

mission aborts because the designator operator is killed; otherwise, the potential COPPERHEAD mission continues to the next test.

2.2.3 Visibility Range. The next test depends on the weather conditions. For the month and time of day that is used for a given case, there is a distribution of weather conditions which includes the probabilities of various cloud ceiling altitude and meteorological visibility range combinations as well as probabilities of various Pasquill atmospheric stability categories, windspeeds, and relative humidities. For each replication of a given case, the cloud ceiling altitude and meteorological visibility range distribution is sampled and the results (cloud ceiling altitude and meteorological visibility limit (range)) obtained are recorded for later use.

The program then samples the acquisition range distribution once for each replication to obtain the range from designator-operator (D.O.) to target terrain unmask for the current replication. If the target unmasks from terrain shielding at a range from the designator-operator beyond the current replication's meteorological visibility limit, then the potential COPPERHEAD mission is aborted since the target cannot be seen and, therefore, cannot be lased by the designator operator; if, on the other hand, the target unmasks at a range less than the visibility limit, then the next test is made.

2.2.4 Designator Maximum Range. Using the above random sample from the acquisition (terrain unmask) range distribution, the next test compares the designator-to-target range with the maximum designator range. If the target is beyond the maximum designation range, then the potential COPPERHEAD fire mission is aborted; otherwise, the tests continue.

At night, the maximum designator range is reduced to the range to which the thermal imagery night sight is usable for aiming the designator.

<u>2.2.5 Target Not Detected.</u> The next test is performed to determine whether the target was in view long enough to be acquired (the entire detection, recognition identification process is lumped into one test and called detection).

After a range from designator-operator to target terrain unmask is obtained as above, a line-of-sight segment length distribution is sampled to obtain the length of the section of the target's path extending from the point of initial terrain unmask to the first point along the path that is obscured from the D.O.'s view. From this line-of-sight segment length together with the target velocity and length of the target unit column, the duration of line-of-sight is calculated. This duration is the time from initial target unmask until the last vehicle in the target unit's column passes out of the D.O.'s view.

To determine whether the target is detected, a time is sampled from a distribution of detection times. This time represents the delay from the time of initial target unmask until the D.O. has detected, recognized, and identified the target and decided to call for COPPERHEAD fire. This is termed detection time.

If the detection time is greater than the duration of the line-of-sight on a particular replication, then the target is considered to have gone in and then out of view before the D.O. could detect it (or really before he could call for fire against it) and the mission aborts. If the detection time is less than the line-of-sight duration, then the D.O. detects and calls for fire on the target before it leaves his line-of-sight and the model continues to the next test.

2.2.6 Smoke. The next test is to determine whether there is sufficient smoke in the area of the target to prevent the D.O. from either seeing or lasing the target. The smoke model computes the fraction of targets that could be obscured from view by taking into account such factors as number and type of RED smoke rounds fired and weather conditions for the month and time of day considered in the current case.

As an alternative to specifying a volume of RED smoke rounds which is then used to calculate the fraction of targets obscured, one can simply input a fractional value which represents the fraction of targets obscured by smoke.

In either case, the fraction of targets (actually fraction of a specified front width) obscured by smoke is played as a "probability of abort due to smoke." For each replication that reaches the smoke test, a random number is drawn from a uniform distribution (from 0 to 1) and if it is less than the probability of abort due to smoke, then the mission is aborted at this step; if it is greater than the probability of abort due to smoke, then the next test is performed.

Note that while the D.O. has a limited target detection capability in smoke by using a thermal site on the designator, the laser beam itself could not penetrate the smoke in those cases where smoke was thick enough to require use of a thermal site. Consequently, COPE plays a "black-white" smoke situation: either smoke completely aborts the mission or has no effect. This is not the case for some of the other COPE variants (such as TAPE, SOPE) where there are three possibilities: (1) smoke is not present and, hence has no effect, (2) smoke is present and kills mission, (3) smoke is present but target can still be detected through thermal site and target is engaged but with reduced accuracy.

2.2.7 Dust. The next test is whether the dust from RED HE artillery fire is sufficient to prevent the D.O. from either seeing the target or lasing it. This is modeled in a very simplistic way in the current generation of COPE.

A probability that dust aborts the mission is estimated outside the COPE program and then input for a given COPE case (either explicitly or by default). Then for each replication that reaches the dust test, a random number is drawn from a uniform distribution (0 to 1) and compared to the probability that dust aborts the mission. If the random number is less than the probability that dust aborts the mission, then the mission is aborted; otherwise, the next test is made.

2.2.8 Designator Bail-Out (Precommo). The next test is to check whether the target is so close to the D.O. that in order to survive he would not engage the target. The assumption is that to avoid being killed by direct fire from potential COPPERHEAD targets, the D.O. would move to a new position whenever the enemy front line units closed to within a certain range; in the case of an isolated lead enemy unit, he might merely refrain from designating rather than move, but in either case he would not be calling for COPPERHEAD fire.

To perform this test, the model compares the D.O.-to-target range against a pre-set "bail-out" range. If the D.O.-to-target range is less than the bail-out range, the mission aborts; otherwise, the mission proceeds to the next test.

Note that this bail-out check is made prior to the D.O.'s call for COPPERHEAD fire. A second bail-out check (see section 2.2.10) is made later.

<u>2.2.9</u> Commo-out (Tests 8 and 9). The next test determines whether the D.O. has a communication link with the F.D.C.

Communication delay time and probability of success (Test 8) can be played in any one of three ways depending on the input option selected:

- (1) A single response time distribution is used together with a single probability of having a good communications link. In this case, a number is randomly sampled from the response time distribution to determine the total delay time from the D.O.'s call for Copperhead fire until the firing battery is ready to pull the lanyard to fire Copperhead. In addition, a second random number is drawn, this time from a uniform (0 to 1) distribution; if this random number is less than the probability of having a good communication link, then the mission proceeds to the Test 9; otherwise, the mission is aborted.
- (2) The second way of playing communication delay time and probability of good communication link is called the "parameterized response time" option. This case is essentially the same as (1) above except that the delay time is set at a single fixed value that is the same for every replication (as opposed to sampling a distribution of delay times to obtain a new delay time value for each replication).

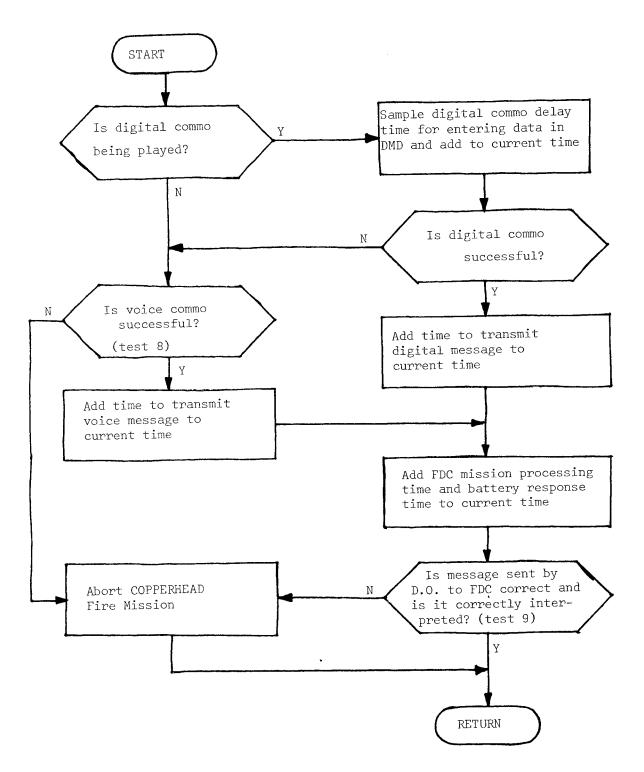


FIGURE 2-3 Third Communication Model

(3) The third way to model the communication delay time is to use a separate delay time for each part of the process from the D.O.'s calling in a fire mission to the battery's pulling the lanyard. Under this method, a delay time distribution is used to obtain digital communication times for D.O. to FDC messages. This delay time is a function of mission type and time of day (i.e., day or night).

The flowchart in Figure 2-3 gives the complete picture of the time delays when this third model is used.

No matter which of the three ways of modeling delay times is used, either communication fails and the mission aborts or communication is established and a delay time is added to the current time. Finally, if communication is established, another random number (uniform between 0 and 1) is drawn and compared to the probability of a successful (i.e., one containing the correct information) message (Test 9). If the random number is less than this probability, the mission proceeds to the next test; otherwise, the mission aborts because the message from the F.O. had bad data or was incorrectly interpreted.

- 2.2.10 Designator Bail-Out After Communication. After the communication from D.O. to FDC to firing battery is completed successfully, the D.O.-to-target distance is updated to account for target movement during the communication and processing delay. If the updated position brings the target within the "bailout" range of the D.O. (see 2.2.8) then the mission is aborted; otherwise, the mission continues with the next test.
- 2.2.11 Line-of-Sight Lost Prior to Firing. The next test is to determine whether the D.O. has lost LOS to the target. The current time (detection time plus communication and processing delay times) is compared to the duration of line-of-sight. If the current time is greater than the duration of line-of-sight, then the target has left the D.O.'s field of view prior to the firing of the first COPPERHEAD and the mission is aborted; otherwise, the mission is fired, the time of flight is added to the current time, and the next test is made.
- 2.2.12 Line-of-Sight Lost During Mission. The tests prior to this affected the entire mission; the sequence of tests after this point is performed separately for each round in the fire mission.

The current time (which is the time the first (next) COPPERHEAD round is to arrive) is compared to the duration of line-of-sight. If the current time is greater than the duration of line-of-sight, then the current round is aborted (ineffective); otherwise, the mission proceeds to the next test.

2.2.13 Designator Not Warned In Time. At the time the first COPPERHEAD round is fired for a given mission, a message is sent to the D.O. by the FDC telling him to begin lasing the target. To determine whether the D.O. receives this message, a random number is drawn from a uniform (0 to 1) distribution and compared to the probability of D.O. warned to lase. If the random number is less than the probability, then the message gets through, the D.O. lases, and the next test is performed; otherwise, the message does not get through, the D.O. fails to lase, and the first round is wasted (aborted).

Even if the message warning the D.O. to lase does not get through for the first COPPERHEAD round, the model assumes that the D.O. would see the first round impact and hence know to begin lasing for the second and subsequent rounds; therefore, rounds after the first round are never lost because of D.O.'s failure to lase.

2.2.14 Designator in Direct Fire. The next test determines whether the D.O. is unable to lase due to incoming direct fire. It is assumed that the target being lased for the COPPERHEAD fire mission has a laser alarm as well as capability that allows it to locate the D.O.'s position (when his laser is on) with sufficient accuracy to fire.

A random number is drawn from a uniform (0 to 1) distribution and compared to probability of kill and probability of suppression values (which are a function of D.O.-to-target range). If the random number is less than the probability of kill, then the D.O. is considered killed and the current round and all subsequent rounds for this replication are aborted. If the random number is greater than the probability of kill but less than the sum of the probability of kill plus the probability of suppression (obscuration due to direct fire), then only the current round is aborted as a result of this test (the test will be performed separately on subsequent rounds of this replication).

If the random number is greater than the probability of kill or suppression, then the mission continues to the next test with no effect from the direct fire.

- 2.2.15 Round Reliability Failure. The round is next tested for inflight reliability. A random number is drawn from a uniform distribution (0 to 1) and compared to the round reliability. If the random number is less than the reliability, the round is reliable and the next test is made; otherwise, the round fails.
- 2.2.16 Target Obscured By Mini-Terrain. The D.O.-to-target range is computed allowing for target movement up to the current model time (actually, the time the first (or next) COPPERHEAD round is to arrive). A distribution of target exposures (due to mini-terrain) at that range is then sampled to determine whether the target is fully exposed, hull defilade (turret exposed), or completely obscured. If the target is completely obscured, then the round aborts; otherwise, the next test is made.

2.2.17 Round Did Not Engage Target. The next test determines whether the COPPERHEAD round receives sufficient reflected laser energy to initiate maneuver to a target and has the target in its maneuver footprint.

To perform this test, a random number is drawn from a uniform (0 to 1) distribution and then compared to a probability of seeker engagement value which is a function of designator-to-target range, visibility range limit, cloud ceiling altitude, delay time, and number of vehicles in column as well as reflectivity of target, seeker sensitivity, target heading, target velocity, nominal COPPERHEAD system response time, gun-target-D.O. angle, designator type, and deflection biases (offsets). The probability of seeker engagement is the probability that both the seeker receives sufficient reflected laser energy to initiate tracking and the target is within the maneuver footprint of the COPPERHEAD round. If the random number is less than the probability of seeker engagement, then the next test is performed; otherwise, the round fails because its seeker cannot engage the target (or can engage but cannot maneuver to the target).

2.2.18 Round Engaged But Did Not Hit. A probability that the round hits the target given that it engages (i.e., passes the previous test) is obtained as a function of range, exposure (fully exposed or hull defilade), and designator type. A table of these probabilities is obtained as output from the LDWSS program and is intended to account for the possibility that the COPPERHEAD seeker tracks laser over-spill or under-spill rather than the target itself.

Again a uniform distribution (0 to 1) is randomly sampled. If the resulting random number is less than the probability that the round hits, then the round hits the target and we proceed to the next test; otherwise, the round misses and aborts.

- 2.2.19 Round Hit But Did Not Kill. The final test is to determine whether the round killed the target given that it hit the target. To perform this test, a random number is drawn from a uniform distribution (0 to 1) and compared to a probability of kill given a hit value which is a function of target type and target exposure (fully exposed or hull defilade). If the random number is less than the probability of kill, then the target is killed; otherwise, the target is not killed and the round aborts.
- 2.2.20 Subsequent Rounds. When a round (not a mission) aborts, subsequent tests in the sequence are not made. Instead, the time is advanced to the next round's arrival time (if there are more rounds left to be considered) and the sequence of tests resumes at the "LOS lost during mission" (section 2.2.12) test for the next round.

If a round does not abort, but instead successfully kills a target, then the time is advanced to the next round's arrival time (if applicable) and the sequence of tests resumes at the "LOS lost during mission" (section 2.2.12) test for the next round.

When no more rounds remain to be fired for a given replication, the replication is ended.

- <u>2.2.21</u> End of Replication. When either a mission (not a round) aborts or all the rounds for a replication have been fired, the replication is considered ended. If more replications remain to be made, the next replication begins with the first test, "Preparatory fires" (section 2.2.2) and proceeds through the sequence of tests as described. If all replications for the current case are done, then the results are printed out and the subsequent case (if any) is begun.
- Model. The step by step description given above of the various tests that must be passed for a successful COPPERHEAD fire mission applies to the "Shooting Gallery" or single continuous LOS segment model. This model assumes that the entire COPPERHEAD mission must be completed during the time interval from the first target vehicle's breaking terrain mask until the last target vehicle leaves that same LOS segment.

The alternate LOS model is called the "Random Occurrence" LOS model and assumes that after the first target vehicle breaks terrain mask, the target vehicles will go in and out of mask at random. The sequence of tests for the random occurrence method is the same as for the shooting gallery except that tests 4 and 11 (sections 2.2.5 and 2.2.11) are omitted and test 12 is modified.

Test 12 (section 2.2.12) is modified so that the probability that at least one target vehicle is visible is given by $Q=1-(1-P)^N$ where P is the probability of a single vehicle being visible if randomly placed along an approach path at the current D.O.-to-target range and N is the number of vehicles left unkilled in the target. A random number is sampled from a uniform distribution (0 to 1) and compared to Q. If the random number is greater than Q, the round is aborted; otherwise, the mission continues with test 13.

2.2.23 Note on Nominal Response Time. The probability of engagement numbers are a function of the time after the D.O.'s call for fire that the rounds arrive. The time is played by establishing a nominal response time $\overline{t_r}$ (an average value for the distribution of total mission communication and processing times which is input and to which is added the time of flight appropriate for the given gun-to-target range.) The model assumes that the D.O. estimates the target's location at $\overline{t_r}$ seconds in the future and calls for fire against that point. The actual COPPERHEAD mission response time is sampled and added to the time of flight to obtain the actual arrival time of the round (t_a) . If t_a is greater than $\overline{t_r}$, then the probability of engagement is lowered because of the larger aiming error and TLE.

This is explained in greater detail in the report on the PAM model. The report on modeling target location error (TLE) discusses the problem of estimating target location and the error in the estimate as a function of time (see bibliography).

The only point important to the user at this stage is that COPE uses two response times: a nominal response time $\overline{t_r}$ and an actual response time t_a . The nominal response time is used to estimate target's future location and hence to choose the point at which to aim. The actual response time is used to determine the probability of seeker engagement (PE). Naturally, if t_a is very large, the probability of the target being at the point estimated (based on $\overline{t_r}$) is quite small.

Also, it was assumed that if the firing battery saw that t_a was likely to be less than $\overline{t_r}$ on a particular occasion, it would hold up firing to cause $t_a = \overline{t_r}$ rather than drop early rounds far in front of the target. This assumes a good communication capability between D.O. and battery.

CHAPTER 3

PERFORMANCE AND LIMITATIONS

3.1 Computer Related Performance and Limitations.

The COPE program (and its preprocessor programs) has been run primarily on the U.S. Army Ballistic Research Laboratory's Control Data Corporation CYBER 76 computer (CDC 7600). On that computer, a typical case with 10,000 replications and six rounds fired per successful COPPERHEAD mission requires 2.5 to 3.0 seconds per case. The computer memory requirement is about 24,000 words (57 Kg) of SCM and no LCM. The disk space required (which will vary with the size of the data base file) for TAPE 11 was about 155,000 words (456 Kg).

COPE has also been run on a CDC 6600 at Aberdeen Proving Ground and on a CDC 6400 and a CDC 6500 at FT. Leavenworth (using the remote terminal at FT. Sill). On these machines, the run time ranged from eight to sixteen times what it was on the CDC 7600. The memory requirements and disk space on the various CDC 6000 series computers were nearly the same as for the CDC 7600.

At the time of this writing, COPE has not been run on any non-CDC machines; however, chapter 13 of this manual considers some of the changes required to do so. Run time would, of course, vary from machine to machine (e.g., the author's experience with other FORTRAN programs suggests run time on the UNIVAC 1108 computer would be eight to ten times that on the CDC 7600).

Most current non-CDC computers use a word size of fewer than 60 bits (the CDC word size). This means that the program memory required to load the object program on most non-CDC machines will be somewhat larger in terms of number of words than for the CDC computers. Similarly, a slight increase in disk space may be required to put the data base file TAPE 11 on a smaller word machine.

3.2 Program Related Performance and Limitations.

The current version of COPE has been run several hundred times now with no errors detected other than those resulting from invalid input, insufficient run time requested, or insufficient print limit set.

The ability of the program to run multiple cases with relatively small streams of input directives has enabled the users to run hundreds of cases with relatively short set up time.

The main limitation encountered in running the program is the requirement that data selected to fill the eight data blocks be on the random access mass storage data base file created by the preprocessor programs. Once these preprocessors are run, any case using data already on the data base file can be easily run. This subject is discussed in detail in chapter 5.

3.3 Model Related Performance and Limitations.

One of the main limitations of the COPE model is that much tactical detail is represented by distributions. For this reason, great care must be taken to interpret input distributions when reporting model results. The interpretation of results depends heavily on the conservatism and objectivity of the analyst.

The only attempt (and indeed the only opportunity) to verify the COPE model was by running it with case descriptors matching as closely as possible conditions present in the COPPERHEAD OT II. When this was done, the results predicted by COPE were compared to those obtained in OT II and found to be in quite close agreement. More precisely, the hypothesis that the probability of hit given a shot as obtained from COPE is equal to the true population probability of hit given a shot could not be rejected even with a significance level as high as 50 percent based on the sample of firings in OT II.

This good agreement of the model to test results should not lead to uncritical acceptance of all COPE results. For one thing, tests 1, 5, 6, and 14 were nulled out (that is, always passed). Also, since the OT II rounds were not live, the probability of kill values (test 19) in the model were set to one (so that kills and hits were considered equivalent).

There are some limitations to the COPE model that need to be explicitly pointed out:

gun, D.O., and target positions is only approximated. For any given simulated COPPERHEAD mission, the gun-to-target range, designator-to-target point-of-unmask range, target heading, and nominal gun-target-designator angle are fixed while the target itself moves (i.e., its position is a function of time).

Figure 3-1 represents the geometry of a COPPERHEAD fire mission.

U is the point of target unmask.

 $\ensuremath{\mathsf{R}}$ is the point at which round is to arrive on target (provided nominal response time is met).

D is the designator operator location.

G is the gun location.

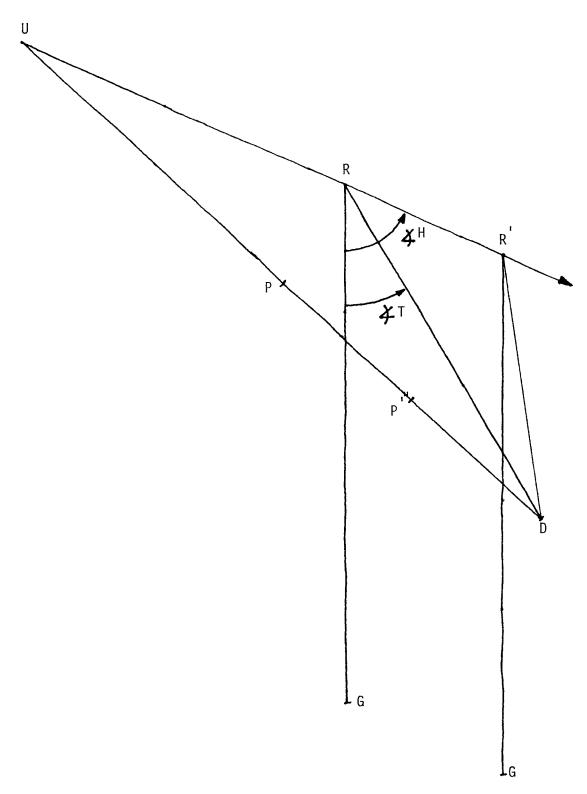


FIGURE 3-1 Geometry of COPPERHEAD Fire Mission

XH is the target heading (angle between gun-target line and target path at time round arrives on target).

XT is the angle between the gun-to-target line (GR) and the designator-to-target line (\overline{DR}).

UR is the target's path (target travels from U to R).

By the COPE case conditions chosen, XT, XH, the length of \overline{GR} , and the length of \overline{UD} are constant (the first three are constant for a given case; the last, length of \overline{UD} , is constant for a given replication, but is sampled anew for each replication). Hence, if the response time is such that the target is at R' on one replication rather than at R (as on, say, a previous replication) when the round arrives, one must move G to $\underline{G'}$, and D to D' to preserve the fixed values of XT, XH, length of \overline{GR} (now G'R').

The requirement that G move to G' is, of course, unrealistic since one does not move the battery to a new site just because nominal response time is not met.

A second compromise in the geometric representation of the COPPERHEAD mission is in calculating the designator-to-target range. Rather than compute the designator-to-target range \overline{DR} (or \overline{DR} ' in the second case) in the correct manner, the COPE model approximates the designator-to-target range by the distance \overline{PD} . P is a point chosen on \overline{UD} such that \overline{UP} = \overline{UR} (or P' such that \overline{UP} ' = \overline{UR} ' in the second case). This approximation is equivalent to the assumption that the target moves straight toward the designator.

One can see from the line segment lengths in Figure 3-1 that \overline{PD} does not differ greatly from \overline{RD} (in this case) whereas $\overline{P'D}$ does differ considerably from $\overline{R'D}$ in length. For typical range values and velocities used so far in COPE, these errors are considered minor. If one is to use greater target velocities or shorter acquisition ranges, then it would be worthwhile to improve this feature of COPE. (That is, incorporate the trigonometry required to correctly calculate \overline{DR} (or $\overline{DR'}$) and use that value instead of \overline{PD} (or $\overline{DP'}$).

Note: The designator operator-to-target distance is used not only at round arrival to calculate probability of engagement and probability of hit; but also throughout the simulation it is updated and used in checking bail-outs, direct fire suppression, line-of-sight probability for random occurrence, etc.

3.3.2 Target Modeling. The COPE model makes simplifying assumptions about the target. In particular, it assumes that the target is a column of vehicles moving at constant velocity with uniform spacing between successive vehicles. When a vehicle is killed, the length of the column is not reduced in length nor is any attempt made to keep a record of the position that the killed vehicle occupied in the column.

These limitations were not deemed serious in the COPE runs for the COPPERHEAD COEA; however, for the SADARM variant of COPE (called SOPE) the model was modified to keep track of individual vehicle status and to handle more general target layouts. (These modifications were essential to SADARM where there is no designator operator to pick out live targets instead of dead ones, and where the volley attacks an area instead of a point as with a single COPPERHEAD round).

3.3.3 Direct Fire Effects Independent. The model of direct fire effects of the target against the D.O. (see section 2.2.14) is oversimplified. The model has a single probability of kill (or obscuration) by direct fire for each target-to-D.O. range and this probability (corrected for then current range) is then applied during each COPPERHEAD round's firing to determine whether the D.O. is killed (or obscured) and thus prevented from lasing.

The shortcomings of this model are (1) subsequent rounds fired by the target at the D.O. should be more accurate both due to adjustment (assuming both that the D.O. survived previous rounds fired by the target and that the target survived previous COPPERHEAD's) by the target after seeing its first round impact and due to the D.O.'s giving away his position more times by the additional lasings, and (2) adjacent vehicles in the target unit, after seeing the lasings for the first few rounds, might join in firing at the D.O. on the latter rounds. Both effects (1) and (2) are omitted in COPE's model of direct fire against the D.O.

- 3.3.4 Only Initial Acquisitions (Unmaskings) Played. The COPE model only plays the first unmasking of each target unit. A more realistic assessment of COPPERHEAD's contribution would be obtained if the target unit were acquired (or, at least, unmasked to provide a potential acquisition) several times as it closes toward the BLUE position. This would require keeping track of the damage done to the RED target unit as the result of previous unmaskings (and the resulting COPPERHEAD fire missions) so as not to take credit for killing vehicles many times over. It would be a fairly straight forward task to modify the COPE program to allow for multiple acquisitions (and firing) of each target unit. The reason this was not done in the original COPE model is simply that all of the acquisition data (range to unmask and line-of-sight segment lengths) available to the model's creators were for first acquisition only.
- 3.3.5 Other Limitations. Other limitations to COPE are chiefly due to either inadequate data or to the desire to keep the model and program simple. These limitations include:
- (a) Availability of artillery to fire the COPPERHEAD mission is not considered.
- (b) The impact of the attrition of a D.O. or an F.O. (forward observer) on the ability of the direct support artillery to perform its mission is not considered. That is, how much of the lost D.O. capability could be

picked up by neighboring D.O.'s, other Fire Support Team (FIST) members, or platoon F.O.'s?

(c) The permanent loss of communications is not played. This could be partially simulated by reducing the probability of a successful transmission, although that value was intended to represent only degradation due to high communication traffic load and electronic warfare.

CHAPTER 4

4. INPUT DIRECTIVES AND "DATA" STATEMENTS

4.1 Input.

Considerable effort has gone into making the COPE input versatile enough to allow for the running of nearly any combination of input parameters while at the same time requiring a minimum of input changes to switch from one case to another. The stacking of multiple cases for a single run can be easily accomplished with relatively few input cards.

The existence of "default" (baseline case) values built into the program allows the program to be run with only the input cards (or card images) required to change those variables which it is desired to set at other than the default values. If further cases are desired one can continue with additional input changes applied to either the previous case or the baseline case.

The program also allows the insertion of up to three types of user comments which may appear in the output.

Finally, in the event that one wishes to use data not in the "data base" file, a "temporary" option using traditional formatted data is available.

4.2 Data Organization.

For each case that is run, there are numerous parameters whose values are set to provide the mathematical description of that case. These parameters are grouped into eight major blocks, six condition keys, and twenty odd individually selected numerically valued variables.

For the most part, a single input card is used to select each block, key, or variable value. There are some exceptions and some dependencies between choices which are explained below (section 4.8).

Finally, there are numerous data items whose values are set in the Block Data (BDATA1) subprogram because they are relatively fixed from case to case. Obviously, if one chose to vary these items frequently, they could be made into input rather than set via data statements. These items are defined below (section 4.7)

4.3 Keyword Input: General Description.

Each input to select a case description (except when the "temporary" option is used) as well as various inputs to control program options is of the form:

where $0 \le n \le 9$. Each such input must be contained on one card (or card image); no continuation to another card is allowed.

The keyword is an alphanumeric character string indicating which case descriptor is to be set by the card.

The option words are either alphanumeric character strings that indicates which option is chosen from a pre-defined set or numerical values that are to be used for certain variables.

Option words are order dependent (i.e., $\frac{\text{keyword}, x, y}{\text{is not}}$ is not equivalent to $\frac{\text{keyword}, y, x}{\text{y}}$). If an option word is omitted, a default value is set by the program. If a keyword takes two or more optionwords and an option word other than the last one is omitted, then the proper number of separators (commas, for example) must be used to position the later optionwords (e.g.,

keyword, default value for option word 1, option word 2

is equivalent to

keyword, , option word 2

but not equivalent to

keyword, option word 2).

In most cases, blanks may be freely inserted within keywords or option words to improve readability. (The only exception is covered in the note of section 4.5.3.).

4.4 Keyword Input: Specifics.

Now each keyword is shown with the option words allowed. Note that new option words may be introduced by running the PREPMS pre-processor program to modify the data base file (section 5.3.8 and chapter 14).

4.4.1 FIRST CASE.

- (a) general form: FIRST CASE
- (b) This card is used only as the first non-comment card in an input deck. If it is omitted, the program will generate a message upon encountering the first non-comment card in the input and then proceed as though the FIRST CASE card were present.

4.4.2 NEXT CASE.

- (a) general form: NEXT CASE, option word 1
- (b) Currently allowed character strings for option word 1 are:
 - (1) RESET DEFAULTS or RD
 - (2) DON'T RESET or DR.
- (c) This card is the first non-comment card of each case other than the first case.

If the option word is <u>RESET DEFAULTS</u>, <u>RD</u>, or omitted, then the values for all case description parameters are reset to their default values and will differ from the baseline values only as determined by the remaining input cards for the current case.

If the option word is <u>DON'T RESET</u> or <u>DR</u>, then the values of the case description parameters remain at their values for the previous case except for those values changed by the remaining input cards for the current case.

If the $\underline{\text{NEXT CASE}}$ card is omitted, the program will generate a message and proceed as though a $\underline{\text{NEXT CASE}}$, $\underline{\text{DR}}$ card had been encountered.

 $\frac{\text{Note}}{\text{Note}}$: The PLOT and CONTROL cards (sections 4.4.5 and 4.4.6) are not controlled by the option on the NEXT CASE card.

4.4.3 END.

- (a) general form: END
- (b) This card belongs at the end of the input for each case other than the final case.

If it is omitted, an error will usually result because the program will continue reading cards that are really part of the next case's input until it either hits an ENDF card, or the end of the input file. This means that the case will run using its own input together with input from subsequent case (or cases). The user can detect this problem from the fact that the case descriptors will probably be incorrect (i.e., other than the intended values) in the case heading print-out, there may be unexpected messages stating that certain input cards have superseded others, and finally, the number of cases in the run will be wrong.

4.4.4 ENDF.

(a) general form: ENDF or END OF FINAL CASE.

(b) This card should be the final card of the final case.

If it is omitted, the program will generate a message on reaching the end of input and then proceed as though an $\overline{\text{ENDF}}$ had been encountered.

If an $\overline{\text{END}}$ card is used instead, there will be no change in the result but the program will waste a few nano-seconds before realizing that there is no more input.

If an $\overline{\text{ENDF}}$ is used prior to the end of the last case, any cards following the $\overline{\text{ENDF}}$ card will be ignored.

4.4.5 PLOT.

- (a) general form: PLOT, option word 1, option word 2
- (b) Allowed character strings for option word 1 are:
 - (1) PRINTER
 - (2) CALCOMP.

Allowed character strings for option word 2 are:

- (1) OFF
- (2) ON.
- (c) This keyword was designed to handle graphic output (bar charts), but has not been implemented in the current version of the program.

The cards <u>PLOT</u>, <u>PRINTER</u>, <u>ON</u> and <u>PLOT</u>, <u>CALCOMP</u>, <u>ON</u> would cause results to be displayed on bar graphs produced by the line printer and Cal-Comp plotter respectively. At the present time, however, these cards will only cause the program to generate a message saying that no plot was produced.

The cards \underline{PLOT} , $\underline{PRINTER}$, \underline{OFF} and \underline{PLOT} , $\underline{CALCOMP}$, \underline{OFF} turn off the production of the bar graphs produced by the line printer and $\underline{Cal-Comp}$ plotter respectively.

The default for option word 1 is $\underline{PRINTER}$; the default for optionword 2 is \underline{OFF} . So no bar graphs (or, at the present time, "no plot" messages) are produced unless positive action is taken by the user.

Note, that if and when this feature is implemented, the two types of graphs may be selected independently of each other.

A <u>PLOT</u> option once selected remains in effect until a further PLOT card is encountered changing the option (that is, ON to OFF or OFF to ON). It is not affected by a <u>NEXT CASE</u>, <u>RD</u> card.

4.4.6 CONTROL.

- (a) general form: CONTROL, option word 1, option word 2
- (b) Allowable choices for option word 1 are:
 - (1) <u>ECHO</u>

Allowable choices for option word 2 are:

- (1) SHORT
- (2) <u>LONG</u>.
- (c) This keyword is designed to control miscellaneous program features. At the present time, the only choice (and the default) for option word 1 is <u>ECHO</u>. If option word 2 is <u>SHORT</u> or omitted, then the short form of the input echoing is used; if option word 2 is <u>LONG</u>, the long form of the input echoing is used (see section 7.6 for input echoing).

The default (which occurs if the card is omitted) is the short form.

A <u>CONTROL</u> option once selected remains in effect until a further <u>CONTROL</u> card is encountered changing the option (that is, <u>LONG</u> to <u>SHORT</u> or <u>SHORT</u> to <u>LONG</u>). It is not affected by a <u>NEXT CASE</u>, <u>RD</u> card.

4.4.7 LINE OF SIGHT MODE.

- (a) general form: LINE OF SIGHT MODE, option word $\underline{1}$ or LOS MODE, option word $\underline{1}$
- (b) Allowable choices for option word 1:
 - (1) SHOOTING GALLERY or SG
 - (2) RANDOM OCCURRENCE or RO.
- (c) The choice of SHOOTING GALLERY or SG for option word 1 causes the current case to be run using the "shooting gallery" line of sight model. If option word 1 is RANDOM OCCURRENCE or RO, then the "random occurrence" line of sight model is used.

The default is the "shooting gallery" model.

4.4.8 MISSION CODE

- (a) general form: MISSION CODE, option word 1 or MSNCODE, option word 1
- (b) Allowable character strings for option word 1 are:
 - (1) PRIORITY PREPLANNED TARGET or PPPT
 - (2) PREPLANNED TARGET or PPT
 - (3) TARGET OF OPPORTUNITY or TOO.
- (c) If option word 1 is <u>PRIORITY PREPLANNED TARGET</u>, <u>PPPT</u>, or omitted, then the mission is considered priority preplanned; if option word 2 is <u>PREPLANNED TARGET</u> or <u>PPT</u>, then the mission is considered preplanned; and, if option word 2 is <u>TARGET OF OPPORTUNITY</u> or <u>TOO</u>, then the mission is considered a target of opportunity.

The mission type affects the response time parameters used (see section 4.4.15) and the modeling of range from unmask to centroid (RUMC, section 4.4.18). See section 4.8 for side effects of mission code choice.

4.4.9 NUMBER OF DIFFERENT TARGET POSTURES.

- (a) general form: <u>NUMBER OF DIFFERENT TARGET POSTURES</u>, option word 1 or <u>NUMDIFTGTP</u>, option word 1
- (b) Allowable character strings for option word 1 are:
 - (1) THREE or 3
 - (2) $\underline{\text{TWO}}$ or $\underline{2}$.
- (c) If option word 1 is <u>THREE</u>, <u>3</u>, or omitted, the target exposure (mini-terrain) model plays three exposures or postures (fully exposed, hull defilade, and completely obscured).

If option word 1 is $\overline{\text{LWO}}$ or 2, the target exposure model plays two exposures (fully exposed and hull defilade) with the completely obscured divided between the other two postures in proportion to their relative fractions.

The default option word 1 is THREE.

4.4.10 TARGET TYPE.

- (a) general form: <u>TARGET TYPE</u>, option word 1
- (b) Allowable character strings for option word 1 are:

- (1) 1
- (2) 2
- $(3) \ \underline{3}$
- $(4) \frac{4}{}$
- (5) 5
- (6) 6
- (c) If option word 1 is i, then the vulnerability values (probability of kill given a hit as a function of target exposure) for target type i are used.

The default target type is 1.

4.4.11 DESIGNATOR TYPE.

- (a) general form: <u>DESIGNATOR TYPE</u>, option word 1 or <u>DESIGTYPE</u>, option word 1
- (b) Allowable choices for option word 1 are:
 - (1) \underline{GLLD} or \underline{G}
 - (2) MULE or M
 - (3) LTD or \underline{L}
- (c) If option word 1 is $\underline{\text{GLLD}}$, $\underline{\text{G}}$, or omitted, the designator type is the $\underline{\text{GLLD}}$; if option word 1 is $\underline{\text{MULE}}$ or $\underline{\text{M}}$, the designator type is the $\underline{\text{MULE}}$; and, if option $\underline{\text{word}}$ 1 is $\underline{\text{LTD}}$ or $\underline{\text{L}}$, the designator type is the $\underline{\text{LTD}}$.

The default designator type is GLLD.

See section 4.8 for side effects of Designator Type Choice.

4.4.12 DO POSITION.

- (a) general form: DO POSITION, option word 1
- (b) Allowable choices for option word 1 are:
 - (1) VANTAGE POINT or VP
 - (2) MANEUVER UNIT or MU.

(c) If option word 1 is <u>VANTAGE POINT</u>, <u>VP</u>, or omitted, then the target posture table gives break down into target exposure as seen from a vantage point.

If option word 1 is $\underline{\text{MANEUVER UNIT}}$ or $\underline{\text{MU}}$, then a target posture table is used which gives the breakdown into target exposures as seen from a position down with the maneuver units.

The default for DO POSITION is VP.

4.4.13 WEATHER.

- (a) general form: WEATHER, option word 1, option word 2 or W, option word $\overline{1}$, option word 2
- (b) Allowable choices for option word 1 are:
 - (1) JUNE or J
 - (2) DECEMBER or D
 - (3) MARCH or M
 - (4) <u>SEPTEMBER</u> or S

Allowable choices for option word 2 are:

- (1) 1400 or 14
- (2) 0600 or 06
- (3) 2200 or 22.
- (c) The weather data used in COPE is grouped into sets of data; each set corresponding to a certain month and time-of-day combination.

The choice for option word 1 determines the month whose weather data are to be used for the current case.

The choice for option word 2 determines the time-of-day whose weather data are to be used for the current case.

The defaults are $\underline{\text{JUNE}}$ or $\underline{\text{J}}$ for option word 1 and $\underline{\text{1400}}$ or $\underline{\text{14}}$ for option word 2.

See section 4.8 for side effects of weather choice.

4.4.14 ACQUISITION RANGE DISTRIBUTION.

(a) general form: ACQUISITION RANGE DISTRIBUTION, option word 1 or ACQRNGDIST, option word 1

- (b) Allowable choices for optionword 1 are:
 - (1) AVERAGE or Λ
 - (2) CLOSE or C
 - (3) OPEN or 0.
- (c) If option word 1 is <u>AVERAGE</u>, <u>A</u>, or omitted, then the acquisition range and line-of-sight segment length distributions used are those for TETAM "average" terrain. If option word 1 is <u>CLOSE</u> or <u>C</u>, then distributions for TETAM "close" terrain are used. If option word 1 is <u>OPEN</u> or <u>O</u>, then distributions for TETAM "open" terrain are used.

The default is to use TETAM "average" terrain.

See section 4.8 for side effects of acquisition data choice.

4.4.15 RESPONSE TIME.

- (a) general form: RESPONSE TIME, option word 1, option word 2, option word 3, or RESPTIME, option word 1, option word 2, or option word 3
- (b) Allowable choices for option word 1 are:
 - (1) FTSILL or FS
 - (2) STAUCH or S
 - (3) SCUNGIO
 - (4) PARAM

Allowable choices for option word 2 are:

- (1) $\underline{\text{DIGITAL}}$ or $\underline{\text{D}}$
- (2) <u>VOICE</u> or \underline{V}
- (3) a positive numerical value (which represents response time in seconds).

Allowable choices for option word 3 are:

- (1) DAY or D
- (2) NIGHT or N.

(c) If option word 1 is <u>FT SILL</u>, <u>FS</u>, or omitted, then the response time distribution supplied by USAFAS at FT Sill is used. This plays the first way of modeling delay time as described in Section 2.2.9.

If option word 1 is $\underline{\mathsf{STAUCH}}$ or $\underline{\mathsf{S}}$, the response time numbers are obtained from the BCS DT II for some processes and TACFIRE tests for others. These data were supplied by Ed Stauch of AMSAA and use the third way of modeling delay time as described in Section 2.2.9.

If option word 1 is <u>SCUNGIO</u>, then the response time distribution used is a hypothetical distribution created by Richard Scungio of AMSAA to test the sensitivity of COPPERHEAD performance to longer response time. In this case the third modeling of response time (see Section 2.2.9) is used.

If option word 1 is PARAM, then the second way of modeling response time delay (see Section 2.2.9) is employed (so-called "parameterized" response time). In this case, the response time is a constant equal to the positive numerical value used as option word 2.

If option word 2 is $\overline{\text{DIGITAL}}$, $\overline{\text{D}}$, or omitted, then digital communication is used (with voice back-up when using the third way of modeling in Section 2.2.9).

If option word 2 is \underline{VOICE} or \underline{V} , then voice communication is used (this will have an affect only when used with the third way of modeling in Section 2.2.9)

If option word 2 is a positive numerical value, then this value is used as the "parameterized" response time. This can only be used with the $\frac{\text{PARAM}}{\text{PARAM}}$ choice for option word 1. A zero or blank option word 2 value used with $\frac{\text{PARAM}}{\text{PARAM}}$ as option word 1 will cause the program to stop (see section 7.5.18).

(Note: If one really wishes to run a zero parameterized response time value, a value of .001 could be used. The difference between these results and those obtained with a true zero response time would be far below the noise in the model).

If option word 3 is \underline{DAY} , \underline{D} , or omitted, day time response times are used. If option word 3 is \underline{NIGHT} or \underline{N} then nighttime response times are used. In addition, the choice of day or night influences the target velocity and maximum designator range (see Sections 4.4.21 and 4.4.22).

The defaults are: for option word 1, $\underline{\text{FTSILL}}$; for option word 2, $\underline{\text{DIGITAL}}$; for option word 3, $\underline{\text{DAY}}$.

See section 4.8 for side effects of response time data choice.

4.4.16 DIRECT FIRE SUPPRESSION.

- (a) general form: DIRECT FIRE SUPPRESSION, option word 1 or DFIRESUPPR, option word 1
- (b) Allowable choices for option word 1 are:
 - (1) HIGH or H
 - (2) NONE or N
- (c) If option word 1 is $\underline{\text{HIGH}}$, $\underline{\text{H}}$ or omitted, then the direct fire suppression (obscuration from direct fire) and kill table used is for a high level of D.O. suppression and kill (corresponding to tank fire at the D.O.)

If option word 2 is $\underline{\text{NONE}}$ or $\underline{\text{N}}$, then there is no effect of direct fire on the D.O..

The default is HIGH.

4.4.17 INVARIANT.

- (a) general form: INVARIANT, option word 1
- (b) Allowable choices for option word 1:

none

(c) The only currently allowed choice for invariant data is the default. Provision for other choices is built into the program for possible future use and may be activated by appropriate preprocessor run(s).

4.4.18 RUMC.

- (a) general form: RUMC, option word 1
- (b) Allowable choices for option word 1 are:
 - (1) \underline{NO} or \underline{N}
 - (2) a numerical value.
- (c) The RUMC (which stands for range from unmask to centroid) value is the distance from the point at which the target breaks terrain mask to the centroid of the COPPERHEAD footprint.

If option word 1 is $\underline{\text{NO}}$, $\underline{\text{N}}$ or omitted, then RUMC is assumed to vary with each replication in $\underline{\text{such}}$ a way that the centroid of the footprint is set at the predicted target (first vehicle) location for first round arrival. This predicted location is based on the nominal (estimated) response time (including time-of-flight) and the target velocity.

The RUMC keyword has an effect only when the <u>MISSION CODE</u> is $\frac{\text{PPPT}}{\text{PPPT}}$ or $\frac{\text{PPT}}{\text{PPT}}$ (see Section 4.4.8). If the $\frac{\text{MISSION}}{\text{MISSION}}$ code is $\frac{\text{TOO}}{\text{NODE}}$, then the program behaves as though option word 1 were $\frac{\text{NO}}{\text{PPPT}}$ regardless of what may be input on a $\frac{\text{RUMC}}{\text{Card}}$.

The default for RUMC is NO.

4.4.19 SMOKE.

- (a) general form: SMOKE, option word 1, option word 2, option word 3
- (b) Allowable choices for option word 1:
 - (1) SMOKE ROUNDS FIRED or SMKRNDS
 - (2) PROBABILITY SMOKE KILLS MISSION or PRBSMOKE.

Allowable choices for option word 2:

(1) a numerical value

Allowable choices for option word 3:

- (1) a numerical value.
- (c) If option word 1 is <u>SMOKE ROUNDS FIRED</u>, <u>SMKRNDS</u>, or omitted, then option words 2 and 3 respectively give the numbers of type 1 smoke rounds fired and type 2 smoke rounds fired.

If option word 1 is PRBSMOKE, then option word 2 gives the probability that smoke kills the potential COPPERHEAD fire mission.

The default for option word 1 is $\underline{\sf SMKRNDS}$. The default for option word 2 is 484 when option word 1 is $\underline{\sf SMOKE}$ ROUNDS $\underline{\sf FIRED}$ or $\underline{\sf SMKRNDS}$, but it is .40 when option word 1 is $\underline{\sf PROBABILITY}$ SMOKE KILLS MISSION or $\underline{\sf PRBSMOKE}$.

The default for option word 3 is 846 when option word 1 is $\underline{\text{NOVNDS FIRED}}$ or $\underline{\text{SMKRNDS}}$; it is unused otherwise.

Note: When the first alternative for SMOKE option word 1 is chosen, the probability that smoke aborts the potential COPPERHEAD mission is calculated as a function of the number of smoke rounds of each type fired and the weather conditions.

When the second alternative is used, the value input for option word 2 (a probability between 0 and 1) is used as the probability that smoke aborts the potential COPPERHEAD mission. (See section 2.2.6)

4.4.20 DO ARTILLERY PK.

- (a) general form: DO ARTILLERY PK, option word 1 or DOARPK, option word 1
- (b) Option word 1 must be either a numerical value between 0 and 1 or omitted.
- (c) The numerical value input for option word 1 is used as the probability that the D.O. is killed by RED preparatory artillery fire.

The default value is .01.

4.4.21 TARGET VELOCITY.

- (a) general form: TARGET VELOCITY, option word 1 or TGTVEL, option word 1
- (b) Option word 1 is a positive number which gives the target velocity in meters per second. (The program is currently set up to accept only 2, 3, 5, 8, or 9 as allowed velocity).
- (c) The value of option word 1 is used as the target velocity.

The default target velocity is obtained from a table (part of the acquisition range data block) giving target velocities as a function of day or night, weather, and terrain type.

Note: For side effects of velocity choice, see section 4.8.

4.4.22 MAXIMUM DESIGNATOR RANGE.

- (b) Option word 1 is a positive number giving the maximum designator range in meters. This is the designator range mentioned in section 2.2.4.

The default maximum designator range is obtained from a table giving ranges as a function of designator type and day or night.

Note: For side effects of designator range value, see section 4.8.

4.4.23 BAIL OUT RANGE.

- (a) general form: BAIL OUT RANGE, option word 1 or BAILOUTRNG, option word 1
- (b) Option word 1 is a positive number giving the bail-out range in meters (see section 2.2.8 and 2.2.10). The default bail-out range is 1000m.

4.4.24 TIME OF FLIGHT.

- (a) general form: <u>TIME OF FLIGHT</u>, option word 1 or <u>TOF</u>, option word 1
- (b) Option word 1 is a positive number giving the time of flight of the COPPERHEAD round in seconds.

The default value for time of flight is obtained from a table giving times of flight as a function of gun-to-target range.

Note: For side effects of time of flight value, see section 4.8.

4.4.25 ANGLE T.

- (a) general form: ANGLE T, option word 1
- (b) Option word 1 is a number giving the angle (in degrees) between the gun-to-target line and the designator-to-target line. The default value is 25 degrees.

Note: For side effects of angle T value, see section 4.8.

4.4.26 DUST.

- (a) general form: DUST, option word 1
- (b) Option word 1 is a number from 0 to 1 whose value is the probability that dust kills the potential COPPERHEAD mission.

The default value is .37.

4.4.27 PROBABILITY OF SUCCESSFUL VOICE TRANSMISSION.

(a) general form: PROBABILITY OF SUCCESSFUL VOICE TRANS-MISSION, option word 1 or PRBVOCTRAN, option word 1

(b) Option word 1 is a number from 0 to 1 whose value is the probability that voice communication is established between the D.O. and the battery FDC.

The default value is .975.

4.4.28 PROBABILITY OF SUCCESSFUL DIGITAL TRANSMISSION.

- (a) general form: PROBABILITY OF SUCCESSFUL DIGITAL TRANS-MISSION, option word 1 or PRBDGTTRAN, option word 1
- (b) Option word 1 is a number from 0 to 1 whose value is the probability that digital communication is established between the D.O. and the battery FDC.

The default value is .915.

4.4.29 ROUND IN FLIGHT RELIABILITY.

- (a) general form: ROUND IN FLIGHT RELIABILITY, option word 1 or RNDFLTREL, option word 1
- (b) Option word 1 is a number between 0 and 1 whose value is the probability that the round is reliable (functions properly).

The default value is .96.

4.4.30 TIME BETWEEN ROUNDS.

- (a) general form: TIME BETWEEN ROUNDS, option word 1 or TBR, option word 1
- (b) Option word 1 is a number whose value is the time (in seconds) between the firing of successive COPPERHEAD rounds.

The default value is 20 seconds.

4.4.31 NUMBER OF REPLICATIONS.

- (a) general form: $\underbrace{\text{NUMBER OF REPLICATIONS, option word 1}}_{\text{NUMREP, option word 1}}$ or
- (b) Option word 1 is the number of replications (i.e., Monte Carlo sample size of potential COPPERHEAD fire missions) to be used for the current case.

4.4.32 NUMBER OF ROUNDS TO BE FIRED.

(a) general form: NUMBER OF ROUNDS TO BE FIRED, option word 1 or NUMRNDS, option word 1

(b) Option word 1 is the number of rounds to be fired on each potential COPPERHEAD fire mission of this case that reaches the point where firing occurs (i.e., a "shot" event). Since each round is fired and completes its flight (successfully or not) before the next round arrives, one may choose to think of the number of rounds to be fired as the number of one round volleys to be fired.

The default value is 6 rounds.

4.4.33 NUMBER OF VEHICLES PER TARGET.

- (a) general form: NUMBER OF VEHICLES PER TARGET, option word 1 or NUMVEHTGT, option word 1
- (b) Option word 1 is the number of vehicles in the target column.

The default value is 10 vehicles.

4.4.34 DISTANCE BETWEEN VEHICLES.

- (a) general form: <u>DISTANCE BETWEEN VEHICLES</u>, option word 1 or DISTBVEH, option word 1
- (b) Option word 1 is the mean distance (in meters) between adjacent vehicles in the target column.

The default value is 61 meters.

4.4.35 GUN TARGET RANGE.

- (a) general form: <u>GUN TARGET RANGE</u>, option word 1 or GTRNG, option word 1
- (b) Option word 1 is the gun-to-target range in kilometers.

The default value is 8 kilometers.

Note: For the side effects of gun-to-target range, see section 4.8.

4.4.36 REFLECTIVITY.

- (a) general form: REFLECTIVITY, option word 1 or REFLECT, option word 1
- (b) Option word 1 is a number between 0 and 1 whose value is the reflectivity of the target to laser energy (i.e., it is the fraction of the laser energy at the designator's frequency that is reflected by the target).

The default value is .10.

Note: The side effects of reflectivity are discussed in section 4.8.

4.4.37 DEFLECTION BIAS.

- (a) general form: <u>DEFLECTION BIAS</u>, option word 1 or <u>DEFB</u>, option word 1
- (b) Option word 1 is the value in meters of the deflection bias which is to be defined as the minimum distance from the target column's path (a line) to the footprint centroid (a point).

The default value is 0.

Note: The side effects of deflection bias are discussed in section 4.8.

4.4.38 TARGET HEADING.

- (a) general form: TARGET HEADING, option word 1 or TGTHDG, option word 1
- (b) Option word 1 is a number whose value is the angle (in degrees) between the target's line of travel and the target-to-qun line.

The default value is 0.

Note: The side effects of target heading are discussed in section 4.8.

4.4.39 SEEKER SENSITIVITY.

- (a) general form: <u>SEEKER SENSITIVITY</u>, option word 1 or <u>SEEKSENS</u>, option word 1
- (b) Option word 1 is a number whose value is the minimum amount (threshold value) of energy per area (in joules per square meter) that must reach the COPPERHEAD seeker in order to initiate maneuver.

The default value is 60 joules/ m^2 . (The true value is not used as the default to avoid any possible classification problem.)

Note: The side effects of the seeker sensitivity value are discussed in section 4.8.

4.4.40 PROBABILITY OF A CORRECT MESSAGE.

- (a) general form: PROBABILITY OF A CORRECT MESSAGE, option word 1 or PROBCORMSG, option word 1
- (b) Option word 1 is a number whose value is the probability that the D.O. sends correct information to the FDC and the FDC interprets it correctly.

The default value is .975.

4.4.41 PROBABILITY DO WARNED TO LASE.

- (a) general form: PROBABILITY DO WARNED TO LASE, option word 1 or PROBDOWARN, option word 1
- (b) Option word 1 is a number whose value is the probability that the message warning the D.O. to begin lasing for the first COPPERHEAD round is transmitted and received successfully.

The default value is .975.

4.5 Special keywords: OVERRIDE, TEMPORARY, RESET.

4.5.1 Correspondence of Data Blocks to Keywords. As mentioned previously, a large part of the data used in each case is grouped into eight blocks. Each of these blocks is normally filled by reading a record from a word addressible mass storage file that is created by the PREPMS and PAM programs. The choice of which particular record to read from the file to fill each data block depends on the various keywords and option words for the case.

This correspondence of data blocks to keywords can be summarized as follows:

	rd to be read for block of this type	Depends on options this (these) keywords
(1)	Weather	WEATHER
(2)	Acquisition range data	ACQRNGDIST
(3)	Response time data	RESPTIME
(4)	Direct fire suppression data	DFIRESUPPR
(5)	Random occurrence data	ACQRNGDIST and TGTVEL
(6)	Probability of engagement data	RESPTIME, MSNCODE, DESIGTYPE, TGTVEL, GTRNG, REFLECT, ANGLE T, DEFLB, TGTHDG, SEEKSENS

(7) Target posture distribution FO POSITION

(8) Invariant data

INVARIANT

As can be seen, there is but one keyword influencing the choice of record to be read for each data block except in the cases of random occurrence data and probability of engagement data.

4.5.2 OVERRIDE and TEMPORARY Features. Two additional methods of filling in a data block are provided. The first is to choose a record from the word addressible mass storage file to be read into the data block without regard to the options chosen for the keyword(s) that would normally determine the record choice; this is the OVERRIDE feature. The second is to actually supply alternative data as traditional formatted FORTRAN inputs to be read into the data block; this is the TEMPORARY feature.

The OVERRIDE option is provided primarily so that one can choose to use probability of engagement (PE) data that has been generated with one set of conditions under other, not too different, conditions without having to re-run the PAM program. For example, PE data for a case with nominal response time, 130 sec. could be used to run a case identical (in those factors affecting PE) except for a nominal response time of 150 sec. The advantage of this procedure is that one can avoid re-running the relatively expensive PĂM program in those cases where the factors affecting PE have changed very little. The disadvantage, of course, is that there are no efficient objective criteria available to determine whether the errors introduced by using wrong (but, it is hoped, approximate) PE data are significant in a given situation.

The TEMPORARY option is provided so that one can directly load data into any data block without having to use the PREPMS preprocessor program. This option allows one to use data for a given run without running the PREPMS program to make that data a "permanent" record in the data base file. This option was provided for flexibility, but was not exercised at all in the original COPPERHEAD Operational Performance Evaluation done for the COEA.

4.5.3 Using the OVERRIDE.

- (a) general form: OVERRIDE, keyword, option word 1 or OVERIDE, keyword, option word 1
- (b) Choices for keyword are:
 - (1) WEATHER or W
 - (2) ACQUISITION RANGE DISTRIBUTION or ACQRNGDIST
 - (3) RESPONSE TIME or RESPTIME

- (4) <u>DIRECT FIRE SUPPRESSION</u> or <u>DFIRESUPPR</u>
- (5) RANDOM OCCURRENCE DISTRIBUTION or RODIST
- (6) PEDATA
- (7) TARGET POSTURE DISTRIBUTION or TGTPSTDIST
- (8) INVARIANT

Option word 1 is the name of any record (on the random access mass storage data base file) containing data for the data block type specified by the keyword choice.

(c) The OVERRIDE causes the selected data block (or blocks, if more than one OVERRIDE card is used in a case) to be filled with data from the record whose name is option word 1.

There is no default for OVERRIDE. An error will result from the omitting of either the keyword or option word 1.

Note: If the record name includes one or more blanks or separators then the record name must be preceded by a "\$" (dollar sign). The ten characters forming the record name must immediately follow the dollar sign, any blanks in the name must be included in their proper positions, and no excess blanks may be inserted. For present purposes, separators include commas, slashes, question marks, and parentheses.

4.5.4 Using TEMPORARY.

- (a) general form: <u>TEMPORARY</u>, keyword or <u>TEMP</u>, keyword
- (b) Choices for keyword are as in section 4.5.3.
- (c) The use of the TEMPORARY option will cause the program to begin reading data in FORTRAN formatted fashion. Hence, each use of the TEMPORARY option must be immediately followed by the formatted data cards to be read to fill the data block selected by the keyword.

The formats to be used and the data to be supplied for each block are identical to those used by the PREPMS program for the corresponding block (see section 14.4.2).

Note: If the keyword is <u>PEDATA</u>, then one has the further option of reading the formatted cards from a separate file (TAPE 4). To use this option, a card: <u>USE TAPE 4</u> must be the next card after the <u>TEMPORARY</u>, <u>PEDATA</u> card; then the formatted data should be on a file to be read by 1/0 unit 4.

There is no default for TEMPORARY.

4.5.5 RESET.

- (a) general form: RESET, keyword
- (b) Allowable keywords are as in section 4.5.3.
- (c) This card will reset the default conditions for the keyword chosen. Its use is mainly to undo an OVERRIDE or a TEMPORARY without having to use NEXT CASE, RD which might reset other defaults not desired.

Note: The effect of an OVERRIDE or TEMPORARY used on PEDATA or RANDOM $\overline{\text{OCCU}}$ RRENCE DISTRIBUTION (RODIST) can be undone only by a RESET, a NEXT CASE, RD, or another OVERRIDE or TEMPORARY for the same data block.

The effect of an OVERRIDE or TEMPORARY for any other data block can also be undone by a card of the usual form for that data block's keyword (i.e., keyword, option word 1, option word 2, ----).

· There is no default on the RESET card.

4.6 Comments.

4.6.1 General Remarks on Comments. The program allows three types of user comment cards to be included in the input. In addition, the program itself generates some comments under certain conditions. The program generated comments are detailed in sections 7.1 and 7.2.

User comments in the input card deck (or card image file) are identified by having "\$" (dollar sign) in the first one, two, or three columns of the card.

4.6.2 \$ Comments. Cards having a "\$" in column 1 but not in column 2 are user comment cards which are totally ignored by the program. When one is read, the program merely goes to the next input card and reads that.

This type of comment is provided only so that the user can leave reminders, separate sections of input, or otherwise label inputs without having an effect on program printouts.

4.6.3 \$\$ Comments. Cards having "\$" in columns 1 and 2 but not in column 3 are user comment cards which are reproduced within the current case's printout only.

The comment (contents of the card) will be reproduced (less the first two columns) with the symbols "** USER **" preceding it in the comment section of the case's printout. (See sample case, Appendix D .)

These comments should be used to note any special details about a case.

4.6.4 \$\$\$ Comments. Cards having "\$" in columns 1, 2, and 3 are user comments that are printed out immediately upon being encountered by the program. Again the symbols "** USER **" are appended to the front of the comment and the \$'s in columns 1-3 are removed.

These comments are printed on a special page separate from any case's printout. It was originally intended that "\$\$\$" comments be put at the beginning of the input before the FIRST CASE card; however, wherever they are put a special page will be printed containing them, and this page will occur in the printout immediately after the previous case's printout; or, (if there has been no case run yet) immediately after the title page.

4.7 DATA Statement Data.

There are many data which are set in data statements rather than read in from cards or disk file with each run or case.

As a general rule, these data are either labels (alphanumeric data) or numbers that do not change from run to run.

All of these data statements have been collected into the BLOCK DATA subprogram BDATA1. They are now described common block by common block:

- $\frac{4.7.1}{\text{ABRLBL}}$. This common block contains the abort labels (i.e., alphanumeric texts) that identify the abort causes on the printouts. They reside in the IDABRT array and are entered as Hollerith constants.
- 4.7.2 ACHAR. This common block consists of the CHAR array which contains the keywords used to input COPE case descriptors. Each keyword is entered as a string of Hollerith constants. In addition, corresponding to each keyword character string are two numbers, the first of which is the keyword number and the second of which is the number of distinct option word character strings allowed with that keyword. (Note: The second number as entered in the data statement line for each keyword is overwritten by numbers taken from the record named OPTNNUMS on the random access mass storage data base file. Thus, when the number of distinct optionword character strings allowed with a given keyword changes, there is no need to adjust the data statement; the pre-processor program PREPMS is used to adjust the value in OPTNNUMS to the correct value. (See section 14.5.)

Also, NREC, the total number of keyword character strings, is set in this common block's data statements.

4.7.3 DESRNG. This common block contains the DESRNG array which consists of the default values for maximum designator range.

DESRNG (I, J) is the maximum designator range for designator type I under condition J where J=1 for day and J=2 for night.

- 4.7.4 DISPLY. This common block contains the DISPT, DISPM, RECLBL, and TMPLBL arrays, all of which are defined in the variable glossary (see chapter 12). Each of these arrays consists of alphanumeric constants entered as Hollerith data.
- The array gives the default times of flight: TOFARY (I) is the COPPERHEAD time of flight for a gun-to-target range of I (currently only I=8 and I=12 are used).
- 4.7.6 FSRESP. This common block consists of the FSRT array which contains the FT Sill supplied response time distribution.
- 4.7.7 HEADNG. This common block contains the ACQLBL, DAYLBL, DFSLBL, DGTLBL, DOLBL, ROLBL, and RSPLBL arrays all of which are defined in the glossary of variables (chapter 12).

Each of these arrays consists of alphanumeric constants entered as Hollerith data.

4.7.8 LOGFLG. This common block contains various logical flags: FIRSTL, SEQNML, SPCL array, and SHRTEC all of which are defined in the glossary of variables (chapter 12).

These are all logical type variables.

- 4.7.9 POINT. This common block contains the IPOINT array used in Subroutine INPUT to direct control to various parts of a computed GOTO.
- 4.7.10 SMOKED. Only the SMK2 and SMK5 arrays plus the variable FRONT of this common block are filled in via data statements. They are all defined in the variable glossary (chapter 12).
- $\frac{4.7.11}{\text{STITLE}}$. This common block contains SLVERS and the VERDAT array. Both are used in the title page printout.
- 4.7.12 SYMBOL. This common block consists of the ALFBET, ANUMBR, and SEP arrays plus the single variables BLANK, DECPNT, and DOLLAR. They are all alphanumeric constants filled in as Hollerith data and defined in the glossary of variables (chapter 12).
- 4.7.13 XVALUE. This common block contains the XVALUE array which is used to generate PEDATA record names. (See sections 5.4 and 9.34.)

4.8 Side Effects of Certain Inputs.

 $\label{thm:constraint} \mbox{There are a number of dependencies and side effects connected} \\ \mbox{with some of the inputs.}$

First, the choice of response time data (4.4.15) and mission code (4.4.8) together with time-of-flight determine the nominal response time. (Time-of-flight itself may be determined either by direct input (4.4.24) or as a result of the choice of gun-to-target range (4.4.35)).

The nominal response time, designator type (4.4.11), target velocity (4.4.21), angle T (4.4.25), gun-to-target range (4.4.35), reflectivity (4.4.36), deflection bias (4.4.37), target heading (4.4.38), and seeker sensitivity (4.4.39) are all used to determine the name of the PE data record (see section 5.4). Indeed, angle T, reflectivity, deflection bias, target heading, and seeker sensitivity play no other roles in COPE than to affect the PE data (by determining the PE data record name) and to appear on the case heading page (see section 6.3) for identification purposes.

The maximum designation range (4.4.22) depends on the time of day (day or night) input with response time data (4.4.15) and the designator type (4.4.11). The maximum designator range can also be set by direct input (4.4.22); however, the user must take care to see that the PE data as well as TTF and RNGTTF arrays contain values appropriate for the maximum designator range used.

The target velocity (4.4.21) can be input directly or as a result of the time of day (day or night) used for the response time data (4.4.15), the month used for weather (4.4.13), and the terrain type (4.4.14) used for acquisition data. (The VELTBL array may need adjusting if additional choices are allowed for acquisition data or weather.)

Finally, the weather data (4.4.13) has a strong side effect on the effectiveness of smoke when the SMOKE option (4.4.19) that plays a specified number of smoke rounds is used.

CHAPTER 5

5. PREPARING TO RUN COPE

Prior to running the main COPE program, it is necessary to run the preprocessor programs to create the word addressable mass storage data base file (TAPE 11). This chapter describes the role of each preprocessor, the structure of TAPE 11, and the interfacing of TAPE 11 with each of the programs by means of the record names.

5.1 Preprocessor Programs.

There are three programs that may be regarded as preprocessors to the main COPE simulation program. These three programs are called:

- (1) PREPMS which stands for preprocessor mass storage,
- (2) PRBLOS which stands for $\underline{probability}$ of $\underline{line-of-sight}$, and
- (3) PAM which stands for <u>probability</u> of seeker <u>acquisition</u> and round <u>maneuver</u>.

More detailed information on PREPMS, PRBLOS, and PAM is included in chapters 14, 15, and 16 respectively of this report. In addition, more thorough documentation of PAM is to be published in a future separate AMSAA Technical Report.

As mentioned in chapter 4 of this report, much of the data used in each COPE case is grouped into eight data blocks. These data blocks are filled by reading records from TAPE 11 (except in the case of the TEMPORARY option described in section 4.5). The main purpose of the PREPMS program (and one of the purposes of the PAM program) is to fill values into the records on TAPE 11 in such a way that they are accessible to the main COPE program.

The PREPMS program is used to fill in records for data blocks for weather data, acquisition range data, response time data, direct fire suppression data, random occurrence data, target posture data, and invariant data. It can also be used to fill in records for PE (probability of engageme data, but this feature has never been used because the PAM program which generates PE data has been modified to write its results directly to TAPE 11 and the choice of record name has been entirely automated in this case. Finally, the PREPMS program is also used to establish and modify the option words allowed as choices with each keyword (described in sections 4.4.1 through 4.4.19 except for those optionword choices described as "a numerical value" in sections 4.4.18 and 4.4.19).

The PRBLOS program is used to calculate the probabilities of line-of-sight at various ranges. These values are then used in the random occurrence line-of-sight model. They are read from the PRBLOS printout and entered by hand as input to PREPMS. Because the PRBLOS program does not directly act on TAPE 11, it shall not concern us further in this chapter (see chapter 15 for complete discussion of PRBLOS).

The PAM program takes as input the parameter values describing the conditions under which probability of engagement is to be computed. It then computes the PE data values, creates a record name for its current block of PE data by encoding the input conditions according to a scheme also used in the main COPE program, and then writes the PE data to TAPE 11 under that record name.

5.2 Word Addressable Mass Storage Data Base File (TAPE 11).

The word addressable mass storage data base file (TAPE II) consists of the records containing the data to be used by each of the eight data blocks mentioned in chapter 4, the records of option words allowed with each keyword (applies only to keywords described in sections 4.4.1 through 4.4.19 and excludes any option words described as "a numerical value"), and a record called OPTNNUMS that records the number of option word character strings allowed for each keyword.

TAPE 11 is a CDC word addressable mass storage file using a name type master index. (This file type and the way it is interfaced with a FORTRAN program is explained in the CDC Fortran Extended Version 4 Reference Manual chapter 8, a section titled "Mass Storage Input/Output"). The important feature to note here is that this file type (with a name type master index) is organized as a set of records each consisting of one or more words of data and each having a unique record name of one to ten characters. This unique record name is set when the record is created and must be used by any program that either reads or modifies the record. It is by using the same system of record names in the COPE program as in the preprocessors PREPPE and PREPMS that the data records written by the preprocessors can be read by the main COPE program.

5.3 Record Names.

5.3.1 Weather Data Record Name. The record name of the data to be used in the weather data block (the WDATA array) has the form: mmmtttt021 where mmm are the first three letters of the name of the month of the weather data, tttt are four numbers giving the time of day (24 hour military time) of the weather data, and the 021 are three numbers signifying that WEATHER has keyword number 21.

Examples:

 $\frac{\text{JUN0600021}}{\text{June day at 0600 (6 AM)}}$ is the record name for weather data for a

 $\frac{\text{SEP2200021}}{\text{September day at 2200 (10 PM)}}$ is the record name for weather data for a

5.3.2 Acquisition Data Record Name. The record name of the data to be used in the acquisition range data block (the ACQDAT array) has the form: ACQDATnn22 where nn are two digits giving the number of the choice for option word 1 used with keyword 22 (section 4.4.14).

Examples:

ACQDAT0122 is the record name of the acquisition range and LOS segment length data to be used when option word AVERAGE is used with keyword 22 (ACQRNGDIST)

ACQDAT0322 is the record name of the data to be used with OPEN terrain.

5.3.3 Response Time Data Record Name. The record name of the data to be used in the response time data block (RSPDAT array) is of the form: RSPDATnn23 where nn are two digits giving the number of the choice for option word 1 used with keyword 23 (section 4.4.15)

Examples:

RSPDATO123 is the name of the record containing the response time data to be used when the FTSILL option is selected.

 $\frac{\text{RSPDATO223}}{\text{response time data for the }} \text{ is the name of the record containing the response time data for the } \frac{\text{STAUCH}}{\text{option}}.$

Note: There is no data record corresponding to the $\underline{\mathsf{PARAM}}$ choice for option word 1. This is because the $\underline{\mathsf{PARAM}}$ choice for option word 1 causes the program not to require any of the data in the response time data block.

5.3 4 Direct Fire Suppression Data Record Name. The record name of the data to be used in the direct fire suppression data block (DFSDAT array) is of the form: DFSDATnn24 where nn are two digits giving the number of the choice for option word 1 used with keyword 24 (section 4.4.16)

Example:

 $\frac{\text{DFSDAT0124}}{\text{data}} \text{ is the record name for } \frac{\text{HIGH}}{\text{direct fire suppression}}$

5.3.5 Random Occurrence Data Record Name. The record name of the data to be used in the random occurrence data block (RODATA array) is of the form: RODAVmTRNn where m is the target velocity in meters per second (obviously between 0 and 9) and n is the terrain type number (corresponds

to number of option word 1 on ACQRNGDIST card, i.e., 1 for AVERAGE, 2 for CLOSE, 3 for OPEN).

Example:

RODAV8TRN2 is the record name for the random occurrence data to be used when target velocity is 8 m/s and terrain type is 2 (CLOSE).

 $\underline{\text{Note}}$: The program is currently set up only for velocities of 2, 3, 5, 8, and 9. Furthermore, 2 and 8 are treated as 3 and 9 respectively when it comes to looking up RODATA and PEDATA.

5.3.6 Target Posture Distribution Data Record Name. The record name of the data to be used in the target posture data block (PSTDAT array) is of the form: PSTDATnn27 where nn is the number of the choice for option word 1 used with keyword 17 (section 4.4.12).

Example:

PSTDAT0127 is the record name for the target posture distribution used when FO POSITION is VANTAGE POINT.

Note: Keyword 17 (FO POSITION) and keyword 27 (TARGET POSTURE DISTRIBUTION) could each be used to control the choice of target posture distribution data, but only keyword 17 (FO POSITION) has been provided with optionwords and is the only one of the two explained in section 4.4.

5.3.7 Invariant Data Record Name. The record name of the data used in the invariant data block (AINVDA array) is of the form: AINVDAnn28 where nn is the number of the choice for option word 1 used with keyword 28.

Example:

AINVDA0128 is the record name for the invariant data used with the default (omitted) option word 1.

Note: The keyword INVARIANT is currently set up to accept no option words (other than a blank which is equivalent to the default).

 $\frac{5.3.8}{41}$ Option Word Record Names. For each keyword numbered less than $\frac{41}{41}$ (see section 5.3.9 for keyword numbers) there may be some option words that are not numerical values (see sections 4.4.1 through 4.4.19 for the current option word choices available with each keyword).

To create, modify, or add to the list of character strings that can be used with any keyword, it is necessary to run PREPMS with input specifying the keyword (in its abbreviated form of ten characters or less), the total number of option word character strings that can be used

with that keyword and the keyword number as well as the option word number, the option word choice number and the option word character string for each option word choice. The formatting of this data is explained in chapter 14, but an explanation of its meaning is provided by the sample input following:

OPTION WORDS, W, 10, 21

1, 2, JUNE

1, 2, J

2, 2, DECEMBER

2, 2, D 1, 3, 1400

1, 3, 14

2, 3, 0600

2, 3, 06

3, 3, 2200

3, 3, 22

where the first line indicates that option word allowable choices are being set for keyword W (or WEATHER), that ten optionword character strings are being input, and that W (or WEATHER) is keyword number 21.

Each of the next ten lines establishes a character string as a possible option word choice. For example, 1, 3, 1400 establishes 1400 as a character string corresponding to the first choice for option word 2 of any input line beginning with keyword W (or WEATHER). The first digit (1) indicates that 1400 is the first choice allowed, the second digit 3 indicates that 1400 is a choice allowed for the third item on the input line (recall that an input line is of the form: Keyword, option word 1, option word 2, - -, option word n so that option word 2 is actually the third item on an input line), and, of course, 1400 indicates that the input character string to select option 1for option word 2 is 1400. The fact that the next line is 1, 3, 14 means that 14 has the same effect (first choice for option word 2) as 1400. No more than two lines are allowed to be input with the same ordered pair (choice number, option word number + 1) under any given keyword (though one may input just one line for such a pair if desired).

The PREPMS program then places this option word information on a record whose record name is the keyword (W in the case above). It is for this reason that the keyword used must be ten or fewer characters. Each keyword of length more than ten characters also has an abbreviated form (see the appropriate section of chapter 4 for each keyword; even some keywords of length less than ten characters have abbreviated forms). For example, the keyword ACQUISITION RANGE DISTRIBUTION is suitable for input to COPE, but cannot be used as input to PREPMS because it is too long to be a record name; instead, the abbreviated form ACQRNGDIST must be used when setting option words via PREPMS.

The rule is always to use the abbreviated form of the keyword with PREPMS input (even if the long form of the keyword is itself ten or fewer characters) and to use either form with input to COPE. For keywords with only one form, use it as input to both programs.

Finally, for each new option word choice that is allowed, the user must consider what COPE will do when it encounters the new option word. In the case of option words that control the choice of records to be read from TAPE 11 into data blocks, the user must also have run PREPMS to add the possible data block records into TAPE 11. In our example above, input to PREPMS must have created records named JUN0600021, JUN1400021, JUN2200021, DEC0600021, DEC1400021, and DEC2200021 containing the weather data to be used with each of the possible option word combinations. For the case of option words that control program actions rather than select a data record name, it will usually be necessary to modify the program code so that it will "know" what to do when encountering a new option.

5.3.9 Keyword Numbers, Abbreviated Forms, Etc. The following table gives the current list of allowed keywords, each keyword's number, abbreviated form, and relevant notes. (This overlays some of the information in chapter 4, but it was felt desirable to have all the keywords listed in one place for quick reference; chapter 4, sections 4.4.1 - 4.4.38 are still essential for allowed optionwords and detailed effects of keywords). When two consecutive keywords have the same number, the second is the abbreviated form. (Recall that blanks may be arbitrarily inserted in (or removed from) keywords.) Notes are explained at end of listing.

Keyword Number	Keyword		Notes
1	FIRST CASE	*1	Sec. 4.4.1
2	NEXT CASE	*2	Sec. 4.4.2
3	END OF CASE	*1	Sec. 4.4.3
3	END	*1	п
4	END OF FINAL CASE	*1	Sec. 4.4.4
4	END F	*1	H
5	PLOT	*2	Sec. 4.4.5
6	OVERRIDE	*3	Sec. 4.5.3
6	OVERIDE	*3	п
7	TEMPORARY	*3	Sec. 4.5.4
7	TEMP	*3	#1

Keyword Number	Keyword	Notes
8	RESET	*3 Sec. 4.5.5
9	CONTROL	*2 Sec. 4.4.6
11	LINE OF SIGHT MODE	*2 Sec. 4.4.7
11	LOS MODE	*2
12	MISSION CODE	*2, *9 Sec. 4.4.8
12	MSN CODE	*2, *9
13	NUMBER OF DIFFERENT TARGET POSTURES	*2 Sec. 4.4.9
13	NUMDIFTGTP	*2 Sec. 4.4.9
14	TARGET TYPE	*2 Sec. 4.4.10
16	DESIGNATOR TYPE	*2, *9 Sec. 4.4.11
16	DESIGTYPE	*2, *9 "
17	FO POSITION	*4 Sec. 4.4.12
21	WEATHER	*4 Sec. 4.4.13
21	W	*4 "
22	ACQUISITION RANGE DISTRIBUTION	*4 Sec. 4.4.14
22	ACQRNGDIST	*4 "
23	RESPONSE TIME	*2, *4, *9 Sec. 4.4.15
23	RESPTIME	*2, *4, *9 "
24	DIRECT FIRE SUPPRESSION	*4 Sec. 4.4.16
24	DF IRESUPPR	*4 "
25	RANDOM OCCURRENCE DISTRIBUTION	*10
25	RODIST	*10
26	PEDATA	*10
27	TARGET POSTURE DISTRIBUTION	*10

Keyword Number	Keyword	<u>Notes</u>
27	TGTPSTDIST	*10
28	INVARIANT	*5 Sec. 4.4.17
31	RUMC	*6 Sec. 4.4.18
32	SMOKE	*7 Sec. 4.4.19
41	DO ARTILLERY PK	*8 Sec. 4.4.20
41	DOARPK	*8 "
42	TARGET VELOCITY	*9 Sec. 4.4.21
42	TGTVEL	*9 Sec. 4.4.21
43	MAXIMUM DESIGNATOR RANGE	*8 Sec. 4.4.22
43	MAXDE SRNG	*8 "
44	BAIL OUT RANGE	*8 Sec. 4.4.23
44	BAIL OUTRNG	*8 "
45	TIME OF FLIGHT	*8 Sec. 4.4.24
45	TOF	*8 "
46	ANGLE T	*9 Sec. 4.4.25
47	DUST	*8 Sec. 4.4.26
48	PROBABILITY OF SUCCESSFUL VOICE TRANSMISSION	*8 Sec. 4.4.27
48	PRBVOCTRAN	*8 "
49	PROBABILITY OF SUCCESSFUL DIGITAL TRANSMISSION	*8 Sec. 4.4.28
49	PRBDGTTRAN	*8 "
50	ROUND IN FLIGHT RELIABILITY	*8 Sec. 4.4.29
50	RNDFLTREL	* 8 "
51	TIME BETWEEN ROUNDS	*8 Sec. 4.4.30

Keyword Number	Keyword		Note	<u>s</u>
51	TBR	*8	Sec.	4.4.30
52	NUMBER OF REPLICATIONS	*8	Sec.	4.4.31
52	NUMREP	*8		II
53	NUMBER OF ROUNDS TO BE FIRED	*8	Sec.	4.4.32
53	NUMRNDS	*8		и
54	NUMBER OF VEHICLES PER TARGET	*8	Sec.	4.4.33
54	NUMVEHTGT	*8		II
55	DISTANCE BETWEEN VEHICLES	*8	Sec.	4.4.34
55	DISTBVEH	* 8		н
56	GUN TARGET RANGE	* 9	Sec.	4.4.35
56	GTRNG	*9		H
57	REFLECTIVITY	* 9	Sec.	4.4.36
57	REFLECT	*9		н
58	DEFLECTION BIAS	* 9	Sec.	4.4.37
58	DEFLB	* 9		tt
59	TARGET HEADING	* 9	Sec.	4.4.38
59	TGTHDG	* 9		II
60	SEEKER SENSITIVITY	* 9	Sec.	4.4.39
60	SEEKSENS	* 9		u
61	PROBABILITY OF A CORRECT MESSAGE	*8	Sec.	4.4.40
61	PROBCORMSG	*8		11
62	PROBABILITY DO WARNED TO LASE	*8	Sec.	4.4.41
62	PROBDOWARN	*8		н

Explanation of notes:

- *1 These keywords do not take option words.
- *2 These keywords set certain flags or indices that cause the program to function in one of several alternate ways or else serve as indices for array "look-ups." Any increase in the number of options corresponding to one of these keywords might require code changes to COPE (at the least, redimensioning of some arrays) to specify the actions to be taken for the new options.
- *3 These keywords take other keywords (numbers 21 through 28) as their second fields (i.e., as the first item following the separator after the keyword). The items to be used in the second fields are built into the program in data statements (CHAR array) and any changes would require code modifications to COPE. (See sections 4.5.1 through 4.5.5)
- *4 These keywords set the names of records on TAPE 11 to be read into the program data blocks. Any increase in the number of options allowed must be accompanied by input to PREPMS creating the records with the names that would be called for if the new options were exercised. (See chapter 14.)

Also, keyword 23 takes some further option words which determine digital or voice communications and day or night visibility. If more options are allowed for these keywords, then code changes are required for COPE.

- *5 Currently takes no option words, but if option words were added, it would fall in the same class as keywords with note *4.
- *6 The addition of any new options for RUMC would require code changes to COPE.
- $\ \ \,$ The addition of any new options for SMOKE would require code changes to COPE.
- *8 These keywords all take numerical values for option word 1. Any numerical value that could be read in F10.4 format is allowable though for some option words negative values or values greater than 1.0 may cause program malfunction (as in the case when the value represents a probability). Any attempt to modify one of these keywords to accept options other than numbers would require program code changes in COPE.
- *9 These keywords affect the choice of the PEDATA record name to be used (see section 5.4). Any increase in the number of allowed choices here would require changing values in the XVALUE array (in both COPE and PAM) and then running PAM to create any new PEDATA records that may be called for as a result of these changes.

In short, one can see from the above notes that while it is easy to add new optionword choices for a particular keyword (by running the PREPMS program when necessary), it often requires code changes to COPE to make the new choices have the desired effect. About the only keywords for which options can be conveniently changed are those of notes 4, 5, and, to a lesser extent, 9.

5.4 PEDATA Record Names.

The record name for the PEDATA (probability of engagement data) to be used with a given case is a function of ten keywords and their associated optionwords (except, of course, when using the OVERRIDE or TEMPORARY keywords with PEDATA).

When the PAM program is run, nine parameters are input. The values of these parameters determine the record name of the PEDATA created by that run. When COPE is run, the same nine parameters are assigned values (as the result of keyword inputs or defaults), the same function for determining record name is applied, and the record with the resulting name is read from TAPE 11 and filled into the PEDATA data block.

Because there are only a finite number of ten character record names and because the record name depends on the values of nine different parameters, it is necessary to limit the choices allowed for each parameter. This section is devoted mainly to a description of the function that determines record name when given the nine parameter values and to the changes required to introduce a new allowed parameter value.

The nine parameters are:

- (1) nominal response time in seconds (determined by keywords 23 and 12),
- (2) designator type (determined by keyword 16),
- (3) target velocity (determined by keyword 42),
- (4) gun-to-target range (determined by keyword 56),
- (5) target reflectivity (determined by keyword 57),
- (6) angle T (i.e., angle between gun-target line and designator target line; determined by keyword 46),
- (7) deflection bias (determined by keyword 58),
- (8) target heading (determined by keyword 59),
- (9) seeker sensitivity (determined by keyword 60).

The values currently allowed are (by parameter number):

- (1) any time t in seconds such that 0.5 second \leq t <999.5 seconds
- (2) GLLD, MULE, LTD (which COPE and PAM call types 1, 2, and 3 respectively)
- (3) 2, 3, 5, 8, and 9 meters per second,
- (4) 8 and 12 kilometers,
- (5) .05, .10, .20, and .30,
- (6) 0, 25, 30, 60, 90, and 120 degrees,
- (7) -200, -100, 0, 100, and 200 meters,
- (8) -60, -30, 0, 30, and 60 degrees,
- (9) 24, 36, 48, 60, and 72 joules per square meter.

The record name function works as follows:

-First, it rounds the nominal response time (parameter one to the nearest integer (call the result t', then $1 \le t' \le 999$).

-Next, for each parameter 2 through 9, the function matches the parameter value to one of the allowed values. Say for the jth parameter, the value is found to match the Ijth allowed value (if no match is found, an error stop results).

-Next, the record name is made by converting t' to octal (call it t" where $\log t$ " ≤ 17478), by letting N_i = a function of I_j (usually I_j -1), and then defining

record name = $20053333xxxxxN_2N_3N_4N_5N_6N_7N_8N_9$ in octal

where: 20053333 is octal for the alphanumeric "PE00", xxxx are the four octal digits of t" (possibly with leading zero(s) if t" is small enough), N2, ___, Ng are as defined above (note that when $1 < I_j < 8$, we have $0 < N_j < 7$ so that each N_j is but a single octal digit. It is for this reason that we shall never allow more than eight different choices for the value of any of the parameters 2 through 9).

The values allowed for each parameter 2 through 9 are to be found in the XVALUE array which is defined by data statements in both COPE and PAM (also, in PREPMS). In COPE, the data statement is in BDAT1, in PAM it is in subroutine PENAME, and in PREPMS it is in BDATA2.

The XVALUE array is set up so that XVALUE (I,J,K) is the Ith allowed value for the Jth parameter when K=1 and XVALUE (I,J,K) is the NJ value (as defined above a function of IJ with $0 < N_J < 7$) corresponding to the Ith allowed value of the Jth parameter when K=2.

Notes: (1) Because the first parameter (nominal response time) is allowed a wider range of values, the XVALUE entries with J=1are not used. (2) Because XVALUE is dimensioned XVALUE (8,9,2) and because not all parameters 2 through 9 actually use the maximum of eight different allowable values, those array spaces XVALUE (I,J,1) and XVALUE (I,J,2) for I greater than the number of allowable values for parameter J are filled with 0's and 8's respectively. Hence, if an NJ value of 8 were to occur, the program has made an invalid parameter value match and a stop with error message will occur. (3) The programs do not distinguish between target velocities of 2 and 3 m/s or between 8 and 9 m/s or between designator types MULE and LTD when it comes to PE data. (There are still distinctions made in other parts of COPE such as calculating current designator target ranges or looking up LDWSS probability of hit numbers as function of designator type). This failure to distinguish can be observed in the XVALUE array: the XVALUE (I,J,2) values are identical for target velocities of 2 and 3 m/s, for example.

To allow more choices for one of the parameters 2 through 9, one need merely modify the data statements defining the XVALUE array so that XVALUE (I, J, 1) with appropriate I and J has the new value and XVALUE (I,J,2) has the corresponding NJ (octal digit). This must be done in both COPE and PAM (and should be done in PREPMS to keep it current also). Then one must run PAM with the parameter combinations using the new allowed value(s) to create the PEDATA corresponding to the case(s) one intends to run in COPE with the new parameter values.

To allow a new choice for parameter 1, one needs merely run PAM with the new value for parameter 1 to create the PEDATA for the case(s) using the new nominal response time and the desired allowed values for the other parameters. Of course, nominal response times outside .5 seconds to 999.5 seconds are not allowed.

Note: The PREPMS program uses the XVALUE array only to decipher PE record names. That is, one can direct that program to list the PEDATA records currently on TAPE 11 and then decipher the PE record names and print the values of the 9 parameters to which each such record corresponds. It is for this reason that the XVALUE array data statement in PREPMS should be updated along with those in COPE and PAM whenever a new value is introduced for any of the parameters 2 through 9.

5.5 Control Cards for COPE and Its Preprocessors.

The appendixes A, B, C, and D at the end of this report include respectively, the control cards used to run PAM, PRBLOS, PREPMS, and COPE. They are explained in these appendixes and hence require no further explanation here. These control card sets, of course, apply only to BRL's computer system and would require minor changes for other CDC installations and major changes for non-CDC computers.

CHAPTER 6

6. OUTPUT

This chapter describes the normal COPE output prints. Special messages and diagnostic or error prints that may occur are described in Chapter 7.

The normal COPE output consists of four types of pages, three of which will always be present and one of which will be present only if one or more "\$\$\$" comments is included in the input.

The page types will ordinarily occur in this order:

Title Page
"\$\$\$" comment page (if present)
First case heading page
First case results page
Second case heading page
Second case results page

nth case heading page nth case results page

final case heading page final case results page

An additional "\$\$\$" comment page will occur following the results page of the last case whose END card precedes any "\$\$\$' comment card (or cards).

Each page type is now described in detail.

6.1 Title Page.

This page includes the program name, the names of the program author and the various contributors to the model design and data collection. In addition, it identifies the activity, division, branch, and section responsible for the model.

Of greater practical value, this page also includes the version number of the program and the date that version was created. Finally, the page gives the date and time of the current run of the program.

For an example, see Listing 6-1.

6.2 "\$\$\$" Comment Page.

This page merely lists the user's "\$\$\$' comments (see section 4.6.4) with the symbol "** USER **" to the left of each comment line. In addition, any program generated comments (see section 7.1) are listed with "**COPE**" to the left of each comment line.

EVALUATION ш N V PERFORM OPFRATIONAL COPPERHEAD

-PROCRAM BY RICHARD SANDMEYER

-MODEL DEVELOPMENT AND DATA COLLECTION BY:

DAVID BARNHART JULIAN CHERNICK DIANA FREDERICK

MICHAEL STARKS

RICHARD SCUNGIO

PICHARD SANDMEYER

EDWARD STAUCH ANNIE YOUNG

-BASED ON A PROPOSAL BY HERBERT FALLIN

-DOME AT THE REQUEST OF DAVID HARDISON (DUSA-OR)

UNITED STATES ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY GROUND WARFARE DIVISION

SYSTEMS EVALUATION SECTION

SUPPORT WEAPONS ANALYSIS BRANCH

COPE VERSION 6.2 CURRENT AS OF 6 MARCH 1980 THIS RUN DONE ON 08/14/80 AT TIME 15.41.16.

LISTING 6-1 TITLE PAGE

For an example, see Listing 6-2.

6.3 Case Heading Page.

The first page for each case is the heading page. The heading page gives a description of the conditions in effect for the case whose results follow. In addition, the heading page contains a section for any "\$\$" comments (either user or program generated). The case heading page (Listing 6-3) begins with a line indicating the case number. The next line below that gives the number of replications (i.e., number of potential Copperhead missions generated and tested by the current case of the Monte Carlo COPE model).

The next area of the case heading page is broken up into nine boxes each of which is surrounded by asterisks and contains descriptors of one aspect of the current case. These boxes are now described one at a time.

Note: When an OVERRIDE or TEMPORARY option is in effect, the case heading information may be unreliable for those items connected with the data block for which the OVERRIDE or TEMPORARY is in effect.

In the special case of a PE data block input via the OVERRIDE option, the values given in the comment of section 7.2.6 take precedent over those in the case heading when it comes to determining PE data but not for other purposes (for example, velocity used for calculating designator-to-target range is the velocity printed in the TARGET box rather than that in the comment).

If in doubt, the user should look at the contents (Data Check) of TAPE 8 for the case in question (see section 7.6) to determine which values were actually used for various parameters.

- $\underline{6.3.1}$ TARGET. The first box is labeled "TARGET" and contains data describing the target. These data are:
 - (a) Target type
 - (b) number of vehicles in the target unit,
 - (c) mean distance between target vehicles,
 - (d) target velocity (speed)
 - (e) target heading (where a heading of zero means the target is moving along the gun-to-target line toward the gun.
 Angles are measured counterclockwise from this zero heading).
 - (f) target reflectivity.
- 6.3.2 FIRING INFO. Moving vertically down the page, one next finds the FIRING INFO box which gives various information about the firing

\$55 \$55 \$58 \$58 \$58 \$58 \$58 \$58 \$58 COMMENTS FOR THIS SET OF CASES \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$

** USER ** THIS COMMENT WILL APPEAR ON THE \$\$\$ COMMENT PAGE

LISTING 6-2 "\$\$\$" COMMENT PAGE

NUMBER OF REPLICATIONS*10000	计算法 医拉拉格特氏 计多数 医多种性 医多种性 医克里氏 医克里氏 医克里氏氏征 医克里氏氏征 医克里氏氏征 医克里氏氏征	新加加加加加加加加加加加加加加加加加加加加加加加加加加加加加加加加加加加加
李母亲你母母母母你母母你你的母亲你母母女女女女女女女女女女女女女女女女女女女女女女	* * DETECT COMMO AND PROC TIMES *	** WEATHER
TYPE 1 **	* * PRIORITY PRE-PLANNED TARGET * * DIGITAL CHAMO	* MONTH OF JUN * TIME OF DAY: 0600
NUMBER OF VEHICLES= 61.M * MFAN DISTANCE BETWEEN VEHICLES= 61.M * TARGET VELOCITY=3. M/SEC	* DAY THE * NOW NAL RESPONSE TIME*106. SEC * NOW NAL RESPONSE TIME*106. 915 *	* ************************************
TARGET HEADING* 0. DEGREES ** TARGET'S REFLECTIVITY* .10 *	* PROB SOUCEST MESSAGE = .975 * * PROB DO WARNED TO LASE = .975 * *	**************************************
群 法本来来看你的法律的法律的法律的法律的法律的法律的法律的法律的法律的证据的	***************************************	21 × c q u + L c C c c +
· · · · · · · · · · · · · · · · · · ·	*************	* CONTINUOUS LOS ("SHOOTING GALLERY")
FIRING INFO *	* DESIGNATOR *	**************************************
NUMBER OF ROUNDS PER ENGAGEMENT= 6 *	* TYPE 1	***************************************
* ROUND KELLABILITY	* MAXIMUM DESIGNATOR RANGE=7000. TH * * BAIL-GUT RANGE=1000. M	* OBSCURANTS
* TIME OF FLIGHT 31.0 SEC * NOMINAL GUN-TAKGET RANGE 8. KM *	* DESIGNATOR AT VANTAGE POINT *	* PROB SMOKE KILLS MISSION* .75 * MALINE OF SMOKE FIRED: 484 + 846
* ANGLE I*: 22. DEGREES * * DEFLECTION BIAS*: 01 METERS *	去六六六安公安安安安安安安安安安安安安安安安安安安安安安安安安安安安安安安安安	+ PROB DUST KILLS MISSION= .37
存款 法查询者 医多种性 医多种性 医多种性 医多种性 医多种性 医多种性 医多种性 医多种性	· · · · · · · · · · · · · · · · · · ·	* ************************************
**************	* DESIGNATOR SUPPRESSED *	
* WISC *	* PROB SUPPRESSED BY INDIRECT FIRE = *01 * * PROB SUPPRESSED BY DIRECT FIRE: HIGH *	
** DELTA T3 ASSUMED TO BE ZERD ** * CFEVED SENSTITUITY= 60. JOULES/M**2 *	* ************************************	

LISTING 6-3 CASE HEADING PAGE

\$

\$\$ \$\$ \$\$ \$\$ \$\$

\$\$ \$\$

\$\$ \$\$ \$\$ \$\$

COMMENTS

** CAPE ** IN PPLOT FOP CASE 1 WITH IPPF6= 1 . NO PLOT PRODUCED .

\$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$

of the COPPERHEAD round. These items are:

- (a) number of rounds fired per engagement,
- (b) round in-flight reliability
- (c) time between successive rounds
- (d) time of flight of round
- (e) nominal gun-to-target range
- (f) angle T (angle between target-to-gun line and targetto-designator line)
- (g) deflection bias (which is the minimum distance between the COPPERHEAD footprint centroid and the target's path).
- $\underline{6.3.3}$ MISC. The next box below the FIRING INFO is labeled MISC and contains miscellaneous data relevant to the case. These data are:
 - (a) either a note that DELTA T3 is zero (in which case RUMC (see section 4.4.18) is optimally chosen for each fire mission or a note that DELTA T3 is not assumed to be zero in which case RUMC is a fixed value for each fire mission.
 - (b) The value of RUMC (if DELTA T3 is not assumed zero; otherwise, this line is not printed.)
 - (c) The seeker sensitivity value used for the COPPERHEAD seeker in this case.
- $\frac{6.3.4~\text{DETECT},~\text{COMMO},~\text{and}~\text{PROC}~\text{TIMES}}{\text{at the top of the second column of boxes contains data pertaining to detection, communication, and processing times. These data are:$
 - (a) The mission type
 - (b) The type of communication (i.e., digital or voice)
 - (c) day or night indicator
 - (d) nominal response time (which is the sum of the median communication and processing times and the time of flight)
 - (e) probability of successful digital communication link being established when needed (not printed when item (b) above is VOICE)

- (f) probability of successful voice communication link being established when needed (printed only when applicable see section 2.2.9)
- (g) probability of a correct message,
- (h) probability that the D.O. is warned to lase.

If the parameterized response time option is used, then the parameterized response time (which does not include time of flight) is listed in this box first.

- 6.3.5 DESIGNATOR. The next box gives information about the designator (both the soldier and the piece of equipment). This information consists of:
 - (a) designator type,
 - (b) maximum designator range,
 - (c) bail-out range
 - (d) designator location.
- $\underline{\text{6.3.6}}$ DESIGNATOR SUPPRESSED. The next box gives information about suppression of the designator. This information is:
 - (a) The probability that the FO (D.O.) is killed by Red preparatory artillery fires.
 - (b) A label giving the level of direct fire suppression achieved by the target against the D.O.
- $\underline{6.3.7}$ WEATHER. The first box of the third column gives weather data. These data are:
 - (a) The month whose weather is being used in the current case,
 - (b) The time of day (on a 0 to 2400 clock) whose weather is being used in the current case.
- $\underline{\text{6.3.8}}$ TERRAIN AND LOS. The next box moving down has terrain and line-of-sight information. This information includes:
 - (a) The terrain type used for the acquisition range distribution and line-of-sight segment length distribution.
 - (b) The line-of-sight model used in the current case ("SHOOTING GALLERY" or "RANDOM OCCURRENCE").

- $\underline{\text{6.3.9}}$ OBSCURANTS. The final box gives data on obscurants (smoke and dust). These data are:
 - (a) Probability that smoke is sufficiently dense to kill a potential COPPERHEAD mission.
 - (b) Number of smoke rounds fired of types one and two respectively to obtain the level of smoke in (a) above. (This is printed only if smoke effects are played as a function of number of smoke rounds fired (see section 4.4.19).
 - (c) Probability that dust from RED HE artillery fire is sufficient to abort a potential COPPERHEAD mission.

6.3.10 "\$\$" Comment Section.

The final section of the heading page for each case consists of a comment section. This comment section includes both any user comments for this case as well as any program generated comments.

6.4 Case Results Page.

Following the heading page for a given case is the case results page. This page is labeled in such a fashion as to be almost self-explanatory (see Listing 6-4).

The page has one line corresponding to each mission abort condition and two lines for each round abort condition. A mission abort occurs whenever one of the tests that affect the entire potential COPPERHEAD mission is failed (see sections 2.2.2 through 2.2.11); a round abort occurs whenever one of the tests that affect the functioning of a single round is failed (see sections 2.2.12-2.2.20).

Beginning at the top of the results page, one finds the number of occasions, which is the number of potential COPPERHEAD missions sampled for the current case. This number should equal the number of replications on the heading page for the same case.

The first seven abort causes (or tests) are those which would prevent the D.O. from even attempting to employ COPPERHEAD against a target.

Each of these causes of abort has one line giving the following information:

- (a) The number of the abort cause (or test),
- (b) a label describing the cause of abort,

													ð	345(3,45%) 702(50,85%)	0(0.00%) 357(100.0%)	144(1,44%) 357(59,66%)	13(0,13%) 213(93,90%)	29(0,29%)	0(0.00%)	49(0.49%)	64(0.64%) 122(47.54%)	58 ****	.58% 5.76% 8.26% 47.16%	657(78.54%)
													ĸ	242(2.42%) 702(65.53%)	0(0.002)	164(1.64%)	9(0.09%)	46(0.46%) 287(83.97%)	0(0.00%) 241(100.0%)	43(0,43%) 241(82,16%)	96(0,96%) 198(51,52%)	102	1.02% 10.13% 14.53% 60.77% N)= 10.07%	
	10000(99.16%)	9916(95.81%)	9501(100.0%)	9501(100.0%)	9501(25.03%)	2378(62,707)	1491(67.547)	* * *	1007(93.05%)	937(97.762)	916(82.64%)	757(92,73%)	₹	151(1.51%) 702(78.49%)	0(0.00%) 551(100.0%)	183(1.83%) 551(66.79%)	16(0.16%) 368(95.65%)	55(0.55%) 352(84.38%)	2(0.02%) 297(99.33%)	54(0.54%) 295(81.69%)	128(1,28%) 241(46,89%)	113	1.137 11.227 16.10% 72.79% PROB(ATMP EHG/NCSN)	NUMBER TESTED (% NOT KILLED) =
***** (00001	ED (% PASSED):	ED (% PASSED):	ED (% PASSED):	ED (% PASSED):	ED (X PASSED):	ED (% PASSED):	ED (% PASSED):	MENTS (1007) ****	ED (% PASSED):	ED (% PASSED):	ED (% PASSED):	HUMBER TESTED (% PASSED):	702) ****	96(0,96%)	0(0.00%)	194(1.94%) 606(67.99%)	15(0.15%) 412(96.36%)	83(0,83%) 397(79,09%)	4(0.04%) 314(98.73%)	74(0,74%) 310(76,13%)	104(1.047)	132	1.327 13.117 18.807 80.057 69.717	141 (1.41%) NU
** CCCASIONS (10000)	NUMBER TESTED (%	NUMBEP TESTED	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	HUMBER TESTED	NUMBER TESTED (%	ATTEMPTED ENGAGEMENTS	NUMBER TESTED	NUMBER TESTED	HUMBER TESTED	NUMBER TEST	***** SHOTS (62(0,62%) 702(91,17%)	0(0,00%)	173(1,73%) 640(72,97%)	16(0.16%) 467(96.57%)	61(0.61%) 451(86.47%)	1(0,01%)	83(0.83%) 389(78.66%)	159(1.59%) 306(48.04%)	147	1.47% 14.60% 20.94% 84.54% ATMP FHG)=	
*	84(0.84%)	415(4.152)	0(0.00%)	0 (0.00%)	7123(71,23%)	887(8.87%)	484 (4.842)	****	70(0.70%)	21(0,212)	159(1.50%)	55 (0,55%)	1	30(0.30%)	15(0.15%) 672(97.77%)	176(1.76%) 657(73.21%)	20(0.20%) 481(95.84%)	54 (0.54%) 461 (88.20%)	1(0.01%)	105(1.05%)	156(1,56%) 301(48,17%)	145	1.457 14.405 20.665 88.777 PP OR (SHQT/ATMP	CASES IN WHICH DESIGNATOR KILLED =
CAUSE OF ABORT	DESIGNATOP IN INDIRECT FIRE	TARGET BEYOND VISIBILITY RANGE	TARGET BEYOND DESIGNATOR RANGE	TARGET HOT DETECTED	SMOKE KILLED MISSION	PUST KILLED MISSIAN	PESIGNATOR BAILED-OUT PRE-CONM		COMMO DUT (BOTH VOICE & DIGTL)	FREOR IN TRANSMISSION	DESIGNATOR BAILED-OUT POST-COM	LOS LOST - NO FIRING	POUND NUMBER :	LOS LOST DURING MISSION NUMBER TESTED (% PASSED)	DESIGNATOR NOT WARNED IN TIME NUMBER TESTED (% PASSED)	PESIGNATOP IN DIPECT FIRE NUMBER TESTED (% PASSED)	ROUND RELIABILITY FAILURE NUMBER TESTED (% PASSED)	TARGET OBSCURED BY MINI-TERRN NUMBER TESTED (% PASSED)	POUND DID NOT ENGAGE TARGET NUMBER, TESTED (3 PASSED)	ROUND ENGAGED BUT DID HOT HIT NUMBER TESTED (% PASSED)	ROUND HIT BUT DID NOT KILL HUMBER TESTED (% PASSED)	**** KILLS	PROB(KILL/OCSN) = PROB(KILL/ATMP ENG) = PROB(KILL/SHOT) = PROB(LOS) = PPOB(SHOT/OCSN) = 7.02%	DESIGNATOR SURVIVABILITY: CASES IN WH
	7	2	ъ	4	3	9	7		ش	0	10	11		175	13	14	15	16	17	18	10			DES

LISTING 6-4 CASE RESULTS PAGE

CAUSE OF ABORT

- (c) the number of times the test was failed,
- (d) the percentage of the total occasions that failed the test
- (e) The number of potential COPPERHEAD fire missions on which the test was performed, (this number is equal to the total number of potential COPPERHEAD fire missions minus the number of potential missions that failed prior tests).
- (f) The percentage of those potential COPPERHEAD fire missions on which the test was performed that passed the test.

Following the seventh abort cause is a line giving the number of attempted engagements. This is the number of replications (out of the total original number of potential COPPERHEAD missions) that passed the first seven tests and have, therefore, reached the point where the D.O. attempts to call for COPPERHEAD fire.

The next four cause-of-abort lines (abort causes numbers 8 through 11) consist of those tests that must be passed before the battery will fire a COPPERHEAD mission. Each of these abort causes has one line giving information as described in (a) through (f) above in this section.

Following the eleventh cause-of-abort line is a line giving number of shots. This is the number of replications for which the mission reached the point where the battery actually fired COPPERHEAD (i.e., the mission passed tests 1 through 11). The number of shots is the number of missions fired, not the number of individual rounds fired.

The final eight abort causes (numbers 12 through 19) are round aborts which have two lines each in the printout.

The first line of each round abort cause gives:

- (a) The number of the abort cause (test),
- (b) a label describing the cause of abort,
- (c) the number of times the test was failed for the first round,
- (d) the percentage of the total occasions for which the first round failed the test.

The line continues with items (c) and (d) repeated but for the second and subsequent rounds up to a total of NRF rounds (NRF<6).

The second line of each round abort gives

- (e) the number of COPPERHEAD mission first rounds on which the test was performed,
- (f) the percentage of those COPPERHEAD fire mission first rounds on which the test was performed that passed the test.

The second line continues with items (e) and (f) repeated but for the second and subsequent rounds of the COPPERHEAD fire mission.

Following the final (19th) abort cause line is a line giving kills. This line gives the number of replications for which the first round of the COPPERHEAD mission achieved a kill, the number of replications for which the second round of the COPPERHEAD mission achieved a kill, and so on through the final round of the COPPERHEAD mission.

Next, the printout gives a number of probabilities derived from the case just simulated: (these probabilities are printed as percentages).

The probability of kill given an occasion for the nth round of the fire mission is printed and is calculated by dividing the number of kills for the nth round by the number of occasions.

The probability of kill given an attempted engagement for the nth round equals the number of kills for the nth round divided by the number of attempted engagements.

The probability of kill given a shot for the nth round equals the number of kills for the nth round divided by the number of shots.

The probability of line-of-sight (LOS) for the nth round is the probability of having LOS when the round arrives (test 12) given that LOS existed immediately prior to firing (test 11). (Note: The preceding applies to the "shooting gallery" LOS model; for random occurrence, the probability of having line-of-sight for the nth round is just equal to the success rate of test 12).

The probability of shot given an occasion is the fraction of potential COPPERHEAD fire missions that actually reach the point where rounds are fired.

The probability of shot given an attempted engagement is the number of shots divided by the number of attempted engagements.

The probability of attempted engagements given an occasion is the number of attempted engagements divided by the number of occasions.

The final line of the results page gives information on designator survivability. This line gives the number of replications in which the designator was killed by direct fire from the target and the percentage of the total replications that number represents. The line also gives the number of replications for which the test of designator kill was performed and the percentage of those replications in which the designator was not killed.

Note: The number of kills shown on the results page differs slightly in its meaning depending on whether "shooting gallery" or "random occurrence" line-of-sight model is used. When "shooting gallery" is used, no attempt is made to account for multiple kills of the same target vehicle (i.e., the number of kills on the nth round is calculated under the assumption that the vehicle the round hit had not already been killed by a previous round).

When "random occurrence" is used, the number of kills on the nth round takes into account the number of vehicles surviving to the nth round.

This difference, of course, has no effect in comparing first round kills computed using the two differing LOS models. Furthermore, for round n there will be no effect from this difference in bookkeeping if (1) n \leq number of vehicles in the target, (2) distance between target vehicles/target velocity \leq time between rounds, and (3) the D.O. is assumed always to designate the front most target vehicle in view. In other cases, the results obtained by the two methods will have some differences attributable to the difference in bookkeeping between the two methods.

CHAPTER 7

7. PROGRAM GENERATED MESSAGES AND DEBUGGING PRINTS

The COPE program has been designed so that most of the common errors will cause the program to come to a stop and print an error message. Of course, it is not possible to anticipate every possible error and the user can expect occasionally to encounter a run that terminates with a dump or a system generated error message. However, the current version of COPE has been used for hundreds of runs now and has not terminated in anything other than the normal program termination or one of the anticipated error stops.

The messages generated by COPE can be divided into five classes:

- (1) program generated \$\$\$ comments,
- (2) program generated \$\$ comments,
- (3) special program print-outs of a warning nature that do not result in program termination
- (4) special program prints that occur with abnormal program terminations and which give information useful in locating the cause of termination.
- (5) STOP messages that are printed in the day file. (These STOPS include the subroutine or function name in which the stop occurs.)

The messages are now explained. They are ordered alphabetically (by first line) within each class. (Note that some messages include more than one line).

7.1 Program Generated \$\$\$ Comments.

YOU HAVE SEQUENCE NUMBERS IN COLUMNS 73-78 OF TAPE 5. THEY WILL BE REMOVED BY THE PROGRAM;
HOWEVER, IF THE TEMPORARY OPTION WAS USED TO READ IN ANY DATA, THE RESULTS MAY BE SUSPECT.

This message is generated in subroutine SEPREC and is part of a modification added to handle a Control Data peculiar problem. Users of COPE frequently create TAPE 5 (the file of case descriptors) using the CDC editor in its default FORTRAN format and then save the resulting file by the command SAVE, LFN (where LFN is the local file name). The problem is that the editor then inserts sequence numbers in columns 73-78 of the saved file. Now one could easily avoid this problem by using SAVE, LFN, N rather than SAVE, LFN (the additional N

causing no sequence numbers to be saved). However, to avoid aborting runs in which sequence numbers are present, COPE was modified to check the first non-comment card (or card image) of file TAPE 5 for sequence numbers: if columns 73-78 are filled with numbers and columns 63-72 and 79-80 are blank, then the computer concludes that sequence numbers are present, issues the above comment, and ignores columns 73-78 on all cards of the current run.

As mentioned in the message itself, this ignoring of columns 73-78 could adversely affect the results if the TEMPORARY option is used, since that option quite likely has important information in columns 73-78. In this event, the file TAPE 5 should be created in the editor with 80 character lines (i.e., use CDC command \underline{F} ,CH=80 before creating the file). Then when it is saved, the sequence numbers will be in columns not read by the program.

For keywords other than TEMPORARY, there is not likely to be any adverse effect since the case descriptor character strings on the cards will usually terminate before column 63 and hence the deletion of columns 73-78 will have no effect.

Finally, if the computer should erroneously conclude that sequence numbers are not present when they really are (as could happen if any of columns 63-72 or 79-80 of the first non-comment card were not blank), then the computer would treat the sequence numbers as part of the keyword or optionword and a different error would bring the program to a halt when that keyword or optionword was not found (see section 7.4.5).

One may wish to remove this feature if using a non-CDC computer.

7.2 Program Generated \$\$ Comments.

7.2.1 CHOICE OF option word FOR RESPONSE TIME DATA IS INCONSISTENT WITH TIME OF option word FOR WEATHER DATA.

The first option word is $\overline{\text{DAY}}$ or $\overline{\text{NIGHT}}$ while the second one is $\overline{0600}$, 1400, or 2200.

This message merely warns the user that one of the following pairs of a RESPONSE TIME data option word and a WEATHER data option word is being used:

RESPONSE TIME option word	WEATHER option word
DAY	2200
NIGHT	0600
NIGHT	1400

These are all considered inconsistent pairs since daylight is usually gone by 2200. On the other hand, day light is usually present at 0600 and 1400.

The choice of one of these inconsistent pairs will not abort the program, but merely result in the generating of this message and the executing of the case with the inconsistent data selected.

7.2.2 IN CCPLOT FOR CASE nn WITH ICCPFG= 1. NO PLOT PRODUCED.

nn is the case number.

This message merely means that the user wanted a Cal Comp plot for case number nn, but since the plot routine is not yet implemented, no plot was produced.

7.2.3 IN PPLOT FOR CASE nn WITH IPPFG = 1. NO PLOT PRODUCED.

nn is the case number.

This message merely means that the user wanted a printer plot for case number nn, but since the plot routine is not yet implemented, no plot was produced.

7.2.4 NO ENDF CARD FOUND BUT ONE ASSUMED SINCE END OF INPUT FILE ENCOUNTERED.

This message occurs when no ENDF card has been put at the end of TAPE 5 (INPUT). It merely means that the program reached the end-of-file without encountering an ENDF card and then proceeded as though it had found one there.

7.2.5 NO 'FIRST CASE' OR 'NEXT CASE' CARD FOUND --- NEXT CASE, RD OPTION ASSUMED.

This message means that inputs for a new case (possibly the first case) have been encountered, but were not preceded by a 'FIRST CASE' or 'NEXT CASE' card. In this event, the program proceeds as though a NEXT CASE, RD card had been encountered prior to the new case's inputs.

7.2.6 PEDATA FOR: TR=xxx. DT= n VEL= yy. GTR= zzz. REFL= a.aa ANGLET= bbb. DEFT= ccc. TGTHD= dd. SKSEN= ee.

xxx., n, yy., zzz., a.aa, bbb., ccc., dd., and ee. are respectively the response time, designator type number, target velocity, gun-to-target range, reflectivity of target, angle T, deflection bias, target heading, and seeker sensitivity used to generate the PEDATA used in this run. This message occurs only when the OVERRIDE option is used with PEDATA.

The units used with each quantity are those normally used on the corresponding keyword cards.

7.2.7 RECORD NAMED: Record Name USED TO OVERRIDE FOR Data Block Name.

Here record name is the name of the record on the word addressible mass storage file that is selected by the OVERRIDE option and data block name is the name of the data block to be filled by this override.

This print occurs only with each data block in a given case for which the OVERRIDE is in effect.

7.2.8 TEMPORARY OPTION IN EFFECT FOR Data Block Name.

Here data block name is the name of the data block filled by use of the TEMPORARY OPTION.

This print occurs only with each data block in a given case for which the TEMPORARY option is in effect.

7.2.9 YOUR INPUT LINE: Input Line Characters SUPERSEDES ONE OF YOUR PREVIOUS INPUT LINES FOR THIS CASE.

The input line characters are the contents of the card that supersedes a previous line. This message is only a warning to the user that he has included two (or more) cards with the same keyword in a single case. When this happens, only the last such card has an effect on the choice of case descriptors.

If two PLOT cards (section 4.4.5) are included in a case (one for CALCOMP and one for PRINTER), then this message will be produced. In such a case, both plot types are set according to the input cards even though the message says the last one superseded the earlier one; this is the one case in which this message can be safely ignored.

In most cases, one will want to check the input cards and probably re-run the case so that no more than one card is used for each keyword. Note that an OVERRIDE or TEMPORARY card applied to a certain keyword counts as an input card with that keyword for purposes of this message (for example, putting an OVERRIDE, W, JUN1400021 card and a W, J, 0600 card in the same case will produce the message of this section).

7.3 Special Program Print-Outs of a Warning Nature That Do Not Result in Program Termination.

7.3.1 IN OUTPUT. PROBLEM 1 J= nnnnn RNDRED=xxxx. NKILL = mmmmm.

nnnnn is the number of the round, xxxx. is the number of kills on the Jth round for this case calculated by adding one each time a kill occurs, and mmmmm is the number of kills on the Jth round for this case calculated by subtracting the number of aborted missions and Jth rounds from the number of replications.

This print occurs only if the Jth round kills (J runs from 1 to NRF) computed by the two methods differ. It indicates a serious problem with the program.

7.3.2 SERIOUS PROBLEM! KTEST AND NTEST ARRAYS DO NOT AGREE II= nnnnn JJ = mmmmm KTEST ARRAY: (Followed By A 20 x 6 Matrix).

nnnnn is the abort number and mmmmm is the round number (or if nnnnn corresponds to a mission abort, mmmmm is 1).

 $\,$ II and JJ are the indices of the first entry in the KTEST and NTEST arrays that do not agree.

The 20 x 6 matrix is the KTEST array where the element in row I column J is KTEST (I, J). The NTEST array elements correspond to the 'number tested' values printed on the case results page where NTEST (I, J) corresponds to the Jth round Ith abort condition (when the abort is a mission abort, J=1).

The KTEST array is filled by incrementing KTEST (I,J) each time the Ith test is made for the Jth round (if the test is for a mission abort J=1). The NTEST array is filled by setting NTEST (I,J) equal to the number of replications minus the number of missions (and Jth rounds) aborted by tests 1 through I-1.

 $\qquad \qquad \text{If NTEST and KTEST differ, then the program is not behaving correctly.}$

- 7.4 Special Program Prints That Occur with Abnormal Program

 Termination and Which Give Information Useful in Locating the Cause of Termination.
 - 7.4.1 ERROR IN INPUT. LINE: Character String WITH IT1=nnnnn IS IN ERROR.

The character string is the card image read from TAPE 5 (INPUT) that is in error and nnnnn is the keyword number.

The error occurs when a keyword match is found for the input, but no code has been provided to handle the input. This is a serious error and means that a program change is required.

This message corresponds to STOP in section 7.5.15.

7.4.2 IN COMMNT. TOO MANY \$\$ COMMENTS (>20): (Followed By 20 Numbered Lines of Comments, Then:) THE FOLLOWING COMMENT CAUSED OVERFLOW OF CMENT ARRAY: (Followed by a 21st Comment Line).

The CMENT array is dimensioned to allow up to 20 \$\$ comments per case. This message means that 21 \$\$ comments were generated for the current case and consequently the CMENT array overflowed. The \$\$ comment count includes both program generated and user comments.

The corrective action is either to reduce the number of comments for the case or increase the second dimension of the CMENT array.

Note: One possible cause of too many comments is the omission of one or more END cards.

This message corresponds to the STOP of section 7.5.1.

7.4.3 INPUT ATTEMPTED TO READ RECORD NAMED Record Name BUT NO SUCH RECORD WAS FOUND.

The record name is the name of the record which the program attempted to read from the word addressible mass storage file but which could not be found on that file.

This message means the desired record does not exist on the mass storage file. In order to create it, one of the pre-processor programs must be run. If the OVERRIDE feature was used, try preceding the record name with a \$ (dollar sign), as described in section 4.5.3.

This message is accompanied by a trace back print of the subroutines called to produce the message. This can be used to locate which call to READMS actually caused the abnormal termination.

This message occurs with the STOP in section 7.5.21.

7.4.4 IN FINDIT. KEYWORD: Keyword AND CORRESPONDING VALUE OF IT: Value ARE NOT ALLOWED WITH THE Option Word OPTION.

Here keyword is the keyword character string, value is the keyword number, and option word is an option word character string.

This message occurs when one attempts to use OVERRIDE, TEMPORARY, or RESET features with an option word that is a keyword other than the name of one of the data blocks.

This message corresponds to the STOP of section 7.5.5.

7.4.5 IN FINDIT. NO MATCH FOUND FOR LINE IB= nnn OF THIS B ARRAY: (Followed By Up to 10 Lines of Character Strings).

Here nnn is the value of IB.

IB is the number of the character string for which no match was found. If IB=1, there was no keyword match (this corresponds to the stop of section 7.5.4). If IB=2, then one could be in the situation of the STOP of section 7.5.4, section 7.5.6 or section 7.5.7.

This error usually means the keyword or option word found in line IB was misspelled or does not exist.

7.4.6 IN NUMRIC. LINE nnn EXCEEDS ALLOWABLE FIELD LENGTH FOR NUMERIC DATA: (Followed By Up to 10 Lines of Character Strings).

Here nnn is the number of the line in the listing of character strings which contains a numerical string of more than 10 characters (including "-" sign and "." if present).

The corrective action is to change the number to one of less than 10 characters (when including "-" and "."). With the parameters used in COPE there should never be occasion to use a number requiring more than 10 characters.

(Note: If the number is written on input without a decimal point, then the program adds a decimal point after the last digit. Hence, if the decimal point is omitted the number should not exceed nine characters).

This error corresponds to the STOP of section 7.5.23.

7.4.7 IN NUMRIC. LINE nnn HAD TOO MANY DECIMAL POINTS: (Followed By Up To 10 Lines of Character Strings).

Here nnn is the number of the line in the listing of character strings which contains more than one ".".

The corrective action is to rewrite the input line so that no option word has more than one decimal point.

This error corresponds to the STOP of section 7.5.22.

7.4.8 IN SMPLCD WITH RANDOM NUMBER GREATER THAN 1.0 RN=xx.xxxxxxx.

Here xx.xxxxxx is the random number generated for use in SMPLCD.

This error will occur only if the random number generator malfunctions and produces a number 1.0. If this error occurs, a trace of subroutine calls is produced and the STOP of section 7.5.31 occurs.

7.5 STOP Messages That are Printed in the Dayfile.

7.5.1 STOP IN COMMNT: TOO MANY \$\$ COMMENTS. This message occurs when too many \$\$ comments are encountered in one case. See section 7.4.2.

- 7.5.2 STOP IN COPE: NORMAL PROGRAM TERMINATION. This is the desirable stop message. It means that the program terminated after processing all the inputs and that no abnormal stopping conditions were encountered. Of course, it does not guarantee that the program did what the user expected, and there may be some warning diagnostic messages (of types 1, 2, or 3 above) produced.
- 7.5.3 STOP IN DFCHK: ERROR NUMBER 1. This stop occurs when the designator-to-target range cannot be bracketed by the range values in the DFFOKL array. This indicates either an error in the range calculation or a need for larger range values in the DFFOKL array.
- 7.5.4 STOP IN FINDIT: ERROR NUMBER 1. This message means that a search of the CHAR array has found no keyword to match that of the current input card. (If the OVERRIDE, TEMPORARY, or RESET option is used, then this message will also occur if the second character string on the card cannot be matched from the CHAR array).

This stop corresponds to the print-out of section 7.4.5.

7.5.5 STOP IN FINDIT: ERROR NUMBER 2. This message occurs when one attempts to use the OVERRIDE, TEMPORARY, or RESET option with anything other than one of the eight data block names. (See section 4.5.)

See section 7.4.4.

7.5.6 STOP IN FINDIT: ERROR NUMBER 3. This message occurs when no match for a given option word from an input card can be found among the allowable option words for the input card's keyword.

See section 7.4.5.

- 7.5.7 STOP IN FINDIT: ERROR NUMBER 4. This message means the same as that in 7.5.6, but occurs at a different point in subroutine FINDIT.
- 7.5.8 STOP IN FPRCNT: ERROR NUMBER 1. This message means that function FPRCNT was called to format into a percentage a number greater than or equal to 100.05. There should never be any percentages greater than 100 in this program, so if this message is obtained, there are major problems in the bookkeeping processes. In particular, the NABORT array and NTEST array are probably filled with wrong numbers.
- 7.5.9 STOP IN GETRNG: TARGET VELOCITY = 0.0. This message means a target velocity of zero was input. This is not allowed since division by zero in calculating line-of-sight duration would cause division overflow on the computer.

If one really wishes to use zero velocity, it is suggested that one use a velocity of, say, .001 which will create line-of-sight durations so great that the end result will not differ significantly from those of a stationary target.

A subroutine call trace is also produced.

7.5.10 STOP IN GETVIS: RANDOM NUMBER TROUBLE 1. This message means that the attempt to sample weather data failed under cloud free line-of-sight conditions.

This probably means that there is an error in the PRGCFL array or the random number generator is malfunctioning.

A subroutine call trace is also produced.

7.5.11 STOP IN GETVIS: RANDOM NUMBER TROUBLE 2. This message means that the attempt to sample weather data failed under no cloud free line-of-sight conditions.

This probably implies that there are invalid numbers in the W array or the random number generator is malfunctioning.

A subroutine call trace is also produced.

 $\frac{7.5.12}{\text{J}}$ STOP IN HEADER: ERROR NUMBER 1. This error occurs only if IOVER (J) has a value other than 0, 1, or 2 for a value of J = 21, 22, 23, 24, 25, 26, 27, or 28.

This should never happen. If it does there is a serious problem somewhere in the input or the random access mass storage file.

- 7.5.13 STOP IN HITCHK: FAILED TO BRACKET RANGE. This stop occurs when the designator-to-target range cannot be bracketed by the range values in the RNGPST array. This indicates either an error in the range calculation or a need for longer range values in the RNGTTF array.
- 7.5.14 STOP IN INPUT: EOF ENCOUNTERED. This stop occurs when an end-of-file is encountered on TAPE 5 after an END card (instead of after the expected ENDF card).
- 7.5.15 STOP IN INPUT: ERROR NUMBER 1. This stop corresponds to the message of section 7.4.1.
- 7.5.16 STOP IN INPUT: EXTRA NEXT CASE CARD. This stop occurs when two (or more) NEXT CASE cards occur within the same case (i.e., without an intervening END card). The program will not accept more than one NEXT CASE card per case. (All cards lying between consecutive END cards are considered to form a case. For this purpose, the beginning and end of TAPE 5 may both be regarded as END cards.)
- 7.5.17 STOP IN INPUT: FIRST CASE CARD IN SUBSEQUENT CASE. This stop occurs if a FIRST CASE card is encountered anywhere on TAPE 5 other than in the first case. Cases other than the first case should be headed by NEXT CASE cards rather than FIRST CASE cards.

- 7.5.18 STOP IN INPUT: PARAMETERIZED RESPONSE TIME ≤ 0.0 . This stop occurs when attempting to play a parameterized response time less than or equal to zero. Such times are not allowed in the program.
- 7.5.19 STOP IN LOSCHK: ERROR WITH RANDOM OCCURRENCE OPTION. This message means that the designator-to-target range cannot be bracketed by the range value in the RNGPLS array. This indicates either an error in the range calculation or a need for larger range values in the RNGPLS array.
- 7.5.20 STOP IN MINTRN: FAILED TO BRACKET RANGE. This stop occurs when the designator-to-target range cannot be bracketed by the range values in the RNGPST array. This indicates either an error in the range calculation or a need for larger range values in the RNGPST array.
- 7.5.21 STOP IN NOREC: ATTEMPTED TO READ NON EXISTENT RECORD. This stop corresponds to the message of section 7.4.3.
 - A subroutine call trace is also produced.
- 7.5.22 STOP IN NUMRIC: ERROR NUMBER 1. This stop corresponds to the error message of section 7.4.7.
- 7.5.23 STOP IN NUMRIC: ERROR NUMBER 2. This stop corresponds to the error message of section 7.4.6.
- 7.5.24 STOP IN PECHK: FAILED TO BRACKET DELTA T. This message means that the time delay cannot be bracketed by the DLTT array time values. This indicates either an error in calculating DELTAT or a need for larger time values in the DLTT array.
- 7.5.25 STOP IN PENAME: ERROR NUMBER 1. This stop means that one of the input values that determines which PEDATA record is to be used had a value not found in the XVALUE array. (See section 5.4.)
- 7.5.26 STOP IN PENAME: ERROR NUMBER 2. This stop means that an illegal index value was assigned to NP in subroutine PENAME. (See section 5.4.)
- 7.5.27 STOP IN PENAME: ERROR NUMBER 3. This stop means that a response time less than zero or greater than or equal to 999.5 was input. This is outside the allowable range of response times.
- 7.5.28 STOP IN PENAME: (PEIDNT) ERROR NUMBER 4. This stop means that the PEDATA record name could not be decoded successfully. (See section 5.4.)
- 7.5.29 STOP IN SEPREC: ERROR NUMBER 1. This error occurs only if the number of keywords and/or option words on an input card is greater than 10 or less than or equal to zero.

7.5.30 STOP IN SMPLCD: FAILED TO BRACKET RANDOM NUMBER. This stop occurs when the random number obtained from the uniform random number (0 to 1) generator cannot be bracketed by the cumulative probability values describing the distribution to be sampled. It indicates either a malfunctioning random number generator or an incomplete description of the distribution to be sampled.

A subroutine call trace is also produced.

7.5.31 STOP IN SMPLCD: RANDOM NUMBER TOO LARGE. This stop corresponds to the error message of section 7.4.8.

A subroutine call trace is also produced.

7.6 Echo Printing.

The COPE program uses TAPE 8 (i.e., logical output unit 8) to echo inputs, to print the values of the case parameters, and to print the initial random number seeds. TAPE 8 is normally a scratch file that is lost when the job is completed; however, if one wishes to see the contents of TAPE 8 for debugging or verification purposes, then one need merely list it or catalog it for future reference.

A sample of TAPE 8 contents is shown in Listings 7-1 and 7-2.

For each case that is run there are two sections of output on TAPE 8. The first section is a listing of the input options (i.e., the case descriptor cards on TAPE 5) that apply to the case.

The second section (Data Check) displays the values of most of the data that describe the case. This section includes data from the word addressable mass storage file (or its equivalent obtained by using the TEMPORARY option), data obtained directly from INPUT cards, and a few computed values. Together, these data give the complete numerical description of the case to be simulated. (This echo print data check has two forms, a long form and a short form. The long form gives all of the data describing the case; the short form gives it all except the PEDATA (i.e., the INDEX and PETBL arrays). (See section 4.4.6.)

Listing 7-1 gives an example of what is printed on TAPE 8 when the short form of the echo print is used. Listing 7-2 shows the TAPE 8 printout when the echo print long form is used.

The values listed in the Data Check section of the TAPE 8 printout are not identified by any printout labeling. Instead, the user must locate the value of a particular variable on the printout by matching the printout lines with the WRITE statements in subroutine ECHO. If the user intends to use this Data Check section frequently, then perhaps some labeling should be added.

In addition to the two sections of output for each case, TAPE 8 also includes the random number seeds. These are printed immediately following the first case data check. Since the random number seeds used for each case are the same, the print of random number seeds is not repeated following the data check prints for subsequent cases.

Note that the column numbers at the top and bottom of each page of Listings 7-1 and 7-2 are not part of the output produced on TAPE 8. They are included here only for the reader's convenience.

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0000000000 1111111222 3456789012	0.0000	000000	.1250	5.0000
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LISTING 7-1 SHORT FORM OF ECHO PRINT - CONT'D

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LISTING 7-2 LONG FORM OF ECHO PRINTS

(PAGE 1 OF 17)

(PAGE 2 OF 17)

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

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LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

LING 1-2 EGING LOW! OF EGING LINEWS

(PAGE 3 OF 17)

0.0000 0.0000 0.0000 . 2800 . 7100 . 7600 . 7500 0.0000 0.0000 0.0000 . 2200 . 6500 . 7400 . 7400 . 7400 . 7300 0.0000 0.0000 0.0000 0.1100 0.3200 0.4500 0.4500 0.2800 0.0000 .0800 .2600 .3600 .3900 .3700 0.0000 0.000 0.0000 0.0000 0.0000 3100 4100 3100 2900 4300 3500 0.0000 0.0000 1100 .5700 .7200 .7800 .6600 .7600 .7600 0.0000 0.0000 0.0000 .1600 .5400 .7300 .7100 .7500 .2300 .3600 .3800 .9700 .9800 .9600 000000 0.0000 0.0000 .2600 .7200 .7300 .6000 .6600 0.0000 0.0000 0.0000 0.0700 0.4200 0.3200 0.3400 0.3600 0.0000 0.0000 .1100 .3700 0.0000 .2900 .2900 .7200 .7100 .6600 .7700 .6700 .9600 .9800 .9700 0.0000 0.0000 0.0000 .5300 .7400 .7100 .6700 .7700 .6700 .7400 0.0000 .0100 .2300 .4500 .4500 .4100 .3700 .3800 0.0000 0.0000 .0000 .1100 .8000 .7400 .7100 .7300 0.0000 .1600 .3500 .3100 .3400 .3700 9400 9500 9700 0000.0 .2600 .7800 .7200 .7400 .7400 .7300 .6900 0.0000 .0700 .3900 .3500 .4100 .3100 .4200 .4600 0.0000 .2600 .7500 .7300 .7600 .6800 .6500 .7100 .6600 .3300 .3400 .3500 .4200 .3200 .2600 .0700 000000 .9500 .9700 .9700 0.000 .4200 .4700 .4700 .4500 .3800 .3800 .3700 .3100 0.0000 .5200 .7800 .7200 .7200 .6800 .7500 .6500 0.000 .2100 .3900 .3800 .4300 .4100 .9400 .9800 .9400 .9600 000000 .2800 000000

COLUMN NOS

17 P. 4 (PAGE

LISTING 7-2 LONG FORM OF ECHO PRINTS

APPAY FUR

0100

.3300 .3100 .3600

.3300

.4700

- CONT'D

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.6800 .7400 .6800 .6900 .7000 .7100 .7200

.1800

ÞE

.7100 .7000 .6600 .7100 .7500 .7700

ARPAY FOR

PF

.1900 0009

0066

ARPAY FOR • 0600 • 0600 • 4000 • 4200 • 4200 • 4200 • 3400 • 3500 ARPAY FOR

.1000

ρF

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	00000 00000 00000 00000 00000 00000 0000	0.0000 0.0000 0.0000 1.0000 1.0000 1.0000 1.0000	0.0000 0.0000 1.0000 1.0000 1.0000 1.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000
0.0000 0.0000 0.0200 0.0500 0.0500 0.0500	00000 00000 00000 00000 00000 00000 0000	000000000000000000000000000000000000000	0.0000 . 2400 . 2400 . 9700 1.0000 1.0000 1.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000
0.0000 0.0000 0.0400 0.0500 0.0300 0.0300	0.0000		0.0000 1.0000 1.0000 1.0000 1.0000 1.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.000 .0100 .0600 .0500 .0400 .0800 .0800	00000 00000 00000 00000 00000 00000 0000		0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 0.0000 0.00000000
. 0100 . 0300 . 0700 . 0300 . 0200 . 0400 . 0300	0.0000 .0100 .0700 .0700 .0200 .0200 .0800		
40000000000000000000000000000000000000	0	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.
	9	A HULL H LA	
	9 B	PE	P FE

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

(PAGE 5 OF 17)

.9400	0.000	0.0000	0000	0090	0096.	.9500	.9700	0096.	. 9800		0.000	0.000	0.000	2,5800	. 7100	3000	1000	7500	7500	000	00000	0000 0	00000	• 2200	. 6500	. 7100	. 6500	. 7000	.7300		0.000	0000	1100	3000	0000	3200	4000	2800	.2700		0.000	00000
. 9200	0.0000	0.0000	. 2500	0000	. 9500	.9700	0086.	0096	.9500		000000	0.000	.1600	.5400	.6700	. 1300	007/	73.00	2000	0007	0.0000	000000	.1100	.5700	. 7200	. 7800	2600	.7100	.6500		0.000	00000	3100	0015	0016	0000	00:30	3800	.3500		0.000	000000
.9500	000000	0000 0	.5700	0000	0056	00%6	0086	0026	. 95.00		0.000	000000	. 2900	00.9	. 7200	0077	. 6600	00//		001/	00000	000000	.2600	• 7200	. 7300	. 7000	0002	. 6600	. 6900		0.0000	0.0000	34.00	4200	0021	00.36	3700	3600	46.00		000000	000000
.9700	000000	.0100	.8800	0076	0800	.0400	.9500	.9500	0020.		000000	0000.0	.5700	.7100	.8000	00 57 -	.7100	.7500	. 300	• / 300	00000	0.0000	.5300	.7400	. 1 00	6900	67.00	.7400	.7100		0000.0	.0100	0062	00017		0014.	2800	3800	3500		000000	0000.0
.9800	000000	.4000	.9400	0000	03.60	.9500	0026	.9700	0026		00000	.2600	.7500	.7300	.7600	.6800	.6500	.7100	0099	.6400	0000	. 2600	.7800	.7200	.7400	.7300	0089	0099	0069		0000 • 0	. 0700	0046	00/6	001:	0016.	3800	0095	4100	! !	0.000	.0700
. 930	[≖ 14 0•0000	.8600	.9500	. 0000	0025	0076	9800	0056	0096	I= 15	0.000.0	.5600	•6500	.7500	0099	.7800	7300	.6800	004/	. 5800 T= 16	0	.5200	.7800	.8000	.7200	.6800	0007.	000	.7100	I= 17	0.000.0	2100	9366	0000	000.	0014.	0006.	0016	0016	I = 18	00000	.2800
0020	PE ARPAY FOR I	0096	0096	0046.	0066	0000	0046	0066	. 9700	ű	•	0069.	• 66 00	. 7400	0039.	0069.	• 7000	• 7100	. 7000	• 7200 • 466 AV FOR 1	1800	0039	.7100	. 7000	. 6600	.7100	. (200	2200	. 7300	ď	•	.3800	.3600	0004.	0024.	0004.	0046.	0076	3500	æ	•1000	• 3700

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

(PAGE 6 OF 17)

	1,000 1,00	3333333444444445555555566666666666677777778888888888
0.0000 0800 3200 3600 3600 3700	0.0000 0.0000	166666677777777 145678901234567
.0200 .2300 .3600 .3400 .3400	0.0000 0.0000	5555556666 34567890123
.1100 .3700 .3600 .3300 .4100 .3500	0.0000 0.	1444444555 34567890123
.1600 .3500 .3100 .3400 .3400 .3700	0.000000000000000000000000000000000000	33333334444 34567890123
.3300 .3400 .3500 .3200 .2600 .4100	00000000000000000000000000000000000000	222222333 3456789012
.4200 .3800 .4700 .4500 .4100 .3100	10000000000000000000000000000000000000	1111111222 3456789012
. 4700 . 3300 . 3700 . 3300 . 3600 . 3600 . 3600	PE ARRAY FOR I = 20 10000	000000000111111111222222233 123456789012345678901234567890

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

(PAGE 7 OF 17)

1.0000
. 9800
1.0000
1.0000 1.0000 1.0000 .9800
1 0000 1 0000 1 0066
1.0000
0066*

7.0000	0066		000000	0.000	0.000	.6200	00/6	0096	0086	. 9600	. 9400	.9700		00000	0000.0	00000	.6800	0096.	0096	.9500	0026	.9600	. 9800		00000	0000	2800	2100	2600	.7800	. 7000	.7500	. 7500		0.0000	0000	2200	6500	7100	. 7400	. 6500	. 7000	.7300	6	00000	0000	00000
.9800	1.0000		000000	0.0000	• 28 00	.8800	0086	.9700	0096	. 9400	.9200	0096.		0.0000	0000.0	.2500	.8400	0006.	.9500	.0700	.9800	0096.	. 9500	1	00000	0000.0	0001.	00464	7300	.7100	. 7500	.7300	.7000	:	0.0000	0000.0	2700	.7200	7800	0099	• 7600	.7100	.6500	4	0.0000	0.0000	0020.
1.0000	0000.		000000	000000	.5700	. 96.00	. 9400	. 9600	. 9500	.9500	.9500	0020.		000000	000000	.5700	.9500	0086.	.9500	. 9600	.9800	.9700	.9500		00000	00000	0067	. 0400	7100	66600	.7700	.6700	.7100		0.000	00000	22000	7300	7000	0069	. 7000	.6600	. 6900		000000	0.0000	00/0.
1.0000	1.0000		000000	.0100	. 5800	. 1800	. 9500	0060.	0066	.9500	.0700	0096.		0000.0	.0100	.8800	0026	0096	0086	0040.	.9500	.9500	• 0700		0.000.0	0.0000	000	001.	00000	7100	.7500	. 7300	.7300		0.0000	00000	. 2300	2100	0004	22.00	00.9	.7400	.7100		000000	.0100	.2300
1,0000	1,0000		000000	•4700	.9500	.9700	.9500	0096	.9300	.9500	0086.	.9800		000000	.4000	.9400	.9800	.9700	.9300	.9500	0026	.9700	.9700		0.0000	.2600	0067.	1,00	0007	6500	.7100	. 6600	• 6400		0.000	. 2600	1300	2,000	7200	0084.	0069	0099	0069		000000	. 0700	.3900
1.0000	1.0000	1= 23	00	.9100	0095	0030.	0066	.9500	0026	0066*	.9300	0096	1= 24	000000	.8600	•9500	0096	0020	.9500	00%	0086	0040	٠.	I* 25	0.000	.5600	.6500	.7500	0000	2300	006.4	.7400	.6800	1= 26	000000	.5200	0087.	. 2000	007.	7500	6500	.8100	.7100	I≖ 27	000000	.2100	.3900
0066	1 - 0000	DE APPAY FOR	ر	0020	.9700	0090.	0086.	.9700	.9500	0096	0026.	0080.	PE APPAY FOR		0096	00%	0076	0000	0800	0000	00%	0066	0026	PE ARPAY FIR	.1900	0069.	0039.	. 7400	. 6800	0060	7100	2007.	. 7200	PE APPAY FOR		0089	. 7100	000/	0000	0017.	6700	22/2	.7300	PE ARPAY FOR	0090	. 3800	.3600

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

(PAGE 8 OF 17)

. 1100 . 3000 . 3200 . 4000	0.0000 0.0000 0.0000 0.0000 0.3200 0.3500 0.3500 0.3700	00 00 00 00 00 00 00 00 00 00 00 00 00	0.0000 0.0000 0.0000 0.0000 0.0200 0.0200 0.0400 0.0400	0.0000 0.0000 0.0000 1.0000 1.0000 1.0000 1.0000
. 4100 . 4100 . 2100 . 4300		00000000000000000000000000000000000000	. 08 00 0. 00 00	0.0000 0.0000 1.900 1.900 1.0000 1.0000 1.0000
. 3500 . 3200 . 3700 . 3700	. 4600 0.0000 0.0000 0.1100 0.3600 0.3800 0.3800	000000000000000000000000000000000000000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.0000 66600 .6600 1.0000 1.0000 1.0000
. 4500 . 4500 . 4100 . 3700 . 3800	0.0000 0.0000 0.0000 1600 3100 3100 3400	00000 00000 00000 00000 00000 00000 0000	000000000000000000000000000000000000000	0.0000 0.0000 0.9900 1.0000 1.0000
. 3500 . 4100 . 4200 . 3800 . 4600	0.0000 0.0000 0.0700 0.3300 0.3500 0.3500 0.3200 0.2600	0.0000 0.0100 0.0100 0.0100 0.0200 0.0200 0.0400	0.0000 0.0000 0.0100 0.0200 0.0200 0.0200 0.0300	0.0000 1.0000 1.0000 1.0000 1.0000 1.0000
. 4300 . 4100 . 3100 . 3100	и п О	# I	H 0	1 = 31 0.0000 1.0000 1.0000 1.0000 .9900 .9900
	PE APPAY FOR 1000 3700 3700 3300 3100 3100 3600	PE APP AY FOX 0100 0500 0500 0100 0100 0200 0100 0500 0500		PE ARPAY FOR 2000 1.0000 1.0000 1.0000 1.0000 1.0000 2.9900 2.9900 2.9900 2.9900 2.9900 2.9900 2.9900 2.9900 2.9900 2.9900 2.99000 2.9

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D (PAGE 9 OF 17)

(PAGE 10 0F 17)

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

COLUMN NOS.

			F APPAY TOR I = 34 9.400
1,0000	0.0000 0.0000 0.0000 1.0000 1.0000 1.0000 1.0000 1.0000	0.0000 0.0000 0.0000 0.0000 9600 9600 9400	0.0000 0.0000 0.0000 0.0000 0.9600 0.9500 0.9500 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0066	0.0000 0.0000 2400 .9700 .9700 1.0000 1.0000 1.0000	0.0000 0.0000 .2800 .8800 .9800 .9700 .9600 .9600	0.0000 .2500 .8400 .9500
1.0000	0.0000 0.0000 1.0000 1.0000 1.0000 1.0000 1.0000	0.0000 .5700 .9400 .9400 .9600 .9500 .9500	0.0000 0.0000 0.0000 0.9500 0.9500 0.9500 0.9700 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
1.0000	0.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000	0.0000 .0100 .0100 .0100 .9900 .9900 .9500 .9500	0,0000 9880 9880 9600 9700
1.0000	0.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000	0.0000 .4700 .9500 .9500 .9500 .9500 .9500 .9500	0.0000 .4000 .9400 .9400 .9700
1.0000	1 32 0.0000 1.00000 1.0000 1.0000 1.0000 1.0000 1.0000	04000000000	11 34 0.0000 0.0
1.0000	PE APRAY FOR 1 - 3200 - 3200 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000	ARFAY F . 4000 . 9700 . 9800 . 9500 . 9500 . 9500 . 9500 . 9500 . 9500 . 9500 . 9500 . 9800 .	PF APRAY FOR . 3400 . 9400 . 9600 . 9800 . 9800 . 9900 . 9

7-25

	2500
. 5500 . 7400 . 5500 . 7000	0.0000 0.0000
.7200 .7800 .6600 .7600 .7100	00000000000000000000000000000000000000
.7300 .7000 .6900 .7000 .6600	0.0000 .3600 .3600 .3700
.6900 .7700 .6700 .7400 .7100	0.0000 0.1000
7300 .7300 .6800 .6600 .6600	0.0000 .3900 .3900 .4200 .4200 .4200 .4200 .4200 .9200 .9200 .0100 .0100 .0200 .0200 .0300 .0100 .0200 .0200 .0200 .0200 .0300 .0200 .0300 .0300 .0300 .0300
. 6800 . 6800 . 7500 . 8100 . 37	0.000000000000000000000000000000000000
.7100 .7500 .7500 .6700 .7700 PE APRAY FO?	PE AFRAY FOR TE ATO 00000000000000000000000000000000000

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

(PAGE 11 OF 17)

(PAGE 12 OF 17)

			.7600 .7400 .7700 .6700 .7400 .6600 .7600 .7000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.300 .2200 .2800 .2700 3.400 .2700 .2700
0.0000 0.0000 0.0000 . 7000 . 8700 . 8400 . 9100	0.0000 0.0000 0.0000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000	0.0000 0.0000 0.0000 0.0000 0.6200 0.6800 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	6700 . 7000 0.0000 0.0000 0.2000 . 2700
0.0000 0.0000 1900 1900 1900 1900 1900 1	0.0000 0.0000 0.2400 9300 9300 9500 9500	0.0000 0.0000 .2800 .7700 .8200 .8200 .6300 .6300 0.0000 0.0000 .2500 .7500 .7500 .7500 .7500 .7500 .7500	7400 7600 0.0000 0.0000 .1600 .2900
0.0000 0.0000 0.0000 8600 .8700 .9000 .8300 .8300	0.0000 0.0000 0.0000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000	0.0000 .5700 .6900 .6900 .7100 .7300 .7300 .7300 .7300 .7300 .7300 .7300 .7300 .7400 .7400	. 7400 . 6400 0.0000 0.2900 . 3400
00000 00000 00000 00000 00000 00000 0000	0000 00100 00100 0050 0050 0050 0050 00	0.0000 .7700 .7700 .6200 .6200 .6300 .6300 .6700 .0100 .7300 .7300 .7300 .7300	0.0000 0.0000 0.0000 0.0000 0.3300 3.3600
0.0000 .9400 .9400 .9300 .8900 .8500	0.0000 9500 9500 9500 9500 9400 9100	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 2600 3200 3200 3200
1= 41 0.0000 8.900 8.800 9.9000 8.800 8.800 8.800 8.900 8.900 8.900 8.900	2	1= 43 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000	1= 45 0.000 .2000 .2000 .2000 .2000 .3200
œ.	PE APPAY FOR . 3200 . 9300 . 9200 . 9100 . 9	PE APPAY FOR 4000	PF ARPAY FUR 1 = 45 - 5200

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

NOS. COLUMN

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CONT'D ı PRINTS ECH0 LONG FORM OF LISTING 7-2

NOS.

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.2400 .2400 .2400 .2400	• ‹	00	.3200 .2000		•		.2800 .3400	0005. 0022.	000000		•	1900 1200	0001.			•	.1600 .1000		0.000	0	0060. 0060.		.1300 .1200		0020		.1000	0000 0 0000 0 0000	0.0000	000000	.0200 0.0000 0.0000					0000	
.2800 .31 .3200 .26 .2500 .24	• 6	•	3600 .32	• •	•	•	2500 .28	• •	0	0090	80. 001.	01.	• 10	•	•	.1200 .14	•16	48	0.00	.0.		• • •	20.	60.	.07	.07	•10	00.00	. 01	. 02	• 05	00.0	00.00	.010	•		•

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0,0000 0,0000 0,0000 0,0000 0,0100 0,0000 0,0000 0.0000 0.0000 0.0100 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0100 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0100 0.0100 0.0200 0.0000

- CONT'D LONG FORM OF ECHO PRINTS LISTING 7-2

(PAGE 14 OF

NOS. 0.0000 .4000 .6400 .8000 .7600 0.0000 .6600 .7100 .7100 .6700 .3400 .6800 .7500 .7400

0.0000 0.0000 0.0000 .6800 .7900

0.0000 0.0000 .2500 .7200 .7600

<u>B</u>E

0.0000 0.0000 0.0000 0.0000 0.0000 0.900 0.9400 0.9400

0.0000 0.0000 2400 9300 9300 9500 9500 9700

0.0000 0.0000 .6000 .9100 .9200 .9500 .9500

0.0000 .0100 .9500 .9300 .9300 .9300 .8800

0.0000 .4700 .9100 .9500 .9200 .9400 .9100 .9200

0.0000 0.0000 0.0000 0.6200 17200 6800 6800 6700

0.0000 0.0000 0.2800 .7700 .7000 .8200 .7300 .6300 .6700

0.0000 0.0000 .0000 .6000 .6500 .7100 .7100 .7300

0.0000 .0100 .7700 .600 .7400 .6200 .7500 .6300

.4700 .4700 .6700 .6700 .6800 .7100 .7700 .6900

bE

P.

0.0000 0.0000 0.0000 . 7000 . 8700 . 9100 . 9100

0.0000 0.0000 11900 8700 9900 9900 98800 88700

0.0000 .0000 .6600 .8700 .9000 .9400 .8700

0.0000 .5000 .9400 .9300 .8200 .9000 .8500

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PE APPAY TOR 1= 55	.6600 .7300 0.0000 .2600 .3200 .3200 .3100 .3400 .2400 .2500 .2500 .2500 .2700 .2700 .2700 .2700	. 2200 . 2400 . 3400 . 3400 . 3500 . 3500 . 3500 . 3500 . 3500 . 3500 . 3500 . 3500 . 3500 . 3500	. 7600 . 7600 . 6400 . 2700 . 2700	. 7300 . 7400 . 7600 0 0000 0 0000 . 1600 . 2800 . 3300 . 3300 . 3300 . 2700 . 2700 . 2700 . 2700 . 2700 . 2700 . 2700 . 2700	. 7200 . 7700 0. 0000 0. 0000 0. 2800 . 2400 . 3400 0. 2200 0. 0000 0. 0000 0. 0000 0. 2200 1. 2800 2. 2800
APP AY FUR I= 550 -1900 -7000 -2900 -2000 -2700 -2900 -3200 -2900 -3200 -2900 -2800 -2900 -2800 -2900 -2800 -2900 -2700 -2700 -2500 -3600 -2700 -3600 -2700 -2700 -2700 -2700 -3100 -2600 -3100 -2700 -3100 -3100 -3100 -3100	2500 2700 3200 3200 3300 3300 3300 3200 2600 26	. 7600 . 7400 . 3300 . 3300 . 3500 . 3500 . 3500 . 3500 . 2500 . 2700 . 2700 . 3600 . 3600 . 3600	. 7400 . 64400 . 60000 . 2200 . 2300 . 2300 . 2300 . 2900 . 2500 . 2500 . 2500 . 2500	. 74 00 . 76 00 . 0 00 00 . 0 00 00 . 2 9 00 . 2 9 00 . 2 9 00 . 3 3 00 . 2 9 00 . 2 5 00 . 3 3 00 . 3 0	. 6700 0.0000 0.0000 0.0000 0.0000 0.2800 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
APAY FOR 1 550 APAY FOR 1 550 2700 2000 2700 2000 2800 2800 2800 2800 2800 3200 2800 3200 2800 3200 2800 3200 2700 3400 AFAY FOR 1 560 2800 2800 2800 2800 3800	7300 2600 3200 3200 3300 3400 2600 2600 2700 2700 2700 2700 2700 2800 2600	7400 0.0000 0.0000 0.0000 0.3000 0.2000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.0000 0.		.7600 0.0000 0.0000 .1600 .2800 .2300 .2300 .3100 .3100 .2700 .2700 .2700 .2700 .2700 .2700 .2700	. 7000 0.0000 0.0000 0.2800 0.2700 0.2700 0.2700 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.2200 0.2200 0.2200 0.2200
APP AY FUR I = 55 -1900 0.0000 0 -2900 .2000 -2900 .2900 -3200 .2900 -2800 .2900 -2800 .2900 -2700 .2500 -2700 .2500 -2700 .2700 -2700 .2700 -2700 .2700 -2700 .2700 -2700 .2900	2500 2500 3200 3200 3300 3400 3100 2500 2500 2700 2700 2200 2200 2500	0.0000 .3300 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500	0.0000 2.200 3.200 3.200 3.200 3.200 5.200 6.0000 6.200 3.200 5.20	0.0000 .1600 .2800 .2800 .2800 .3300 .3100 .2500 .2900 .2900 .2900 .2900	0.0000 0.00000 0.2800 0.3400 0.2700 0.2700 0.2700 0.2200 0.0000 0.0000 0.0000 0.0000 0.2200 0.2200 0.2200 0.2200 0.2200 0.2300
2900 0.0000 0.2000 2.20	2600 2700 3200 3200 3300 3300 3100 2600 2600 2600 2700 2700 2800 2800 2800	000000 000000 000000 000000 000000 00000	0.0000 .2200 .2200 .2300 .2300 .2800 .2800 .2600 .2600 .2600 .2600 .2500 .2500	0.0000 0.0000 0.0000 0.2700 0.2700 0.0000 0.0000 0.1100 0.2700 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500	0.0000 0.00000 0.00000 0.2800 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.00000 0.00000 0.00
AFAY FOR .2500 .2700 .2600 .3200 .2800 .2800 .2800 .2800 .2800 .2700 .3200 .2500 .3400 AFAY FOR I = 56 .1800 .3800 .2700 .3800 .2700 .3800 .3100 .3800 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700 .2600 .2700	2500 2700 3700 3700 3100 3100 2500 3200 3200 3200 2700 2700 2700 2700 27	0.0000 .3300 .3500 .3500 .3500 .3500 .3500 .3200 .3200 .3200 .3200 .3200 .3200	0.0000 .2200 .3400 .3700 .3700 .2700 .2700 .2700 .2000 .2000 .3200 .3300 .3300 .3700	0.0000 .1600 .2800 .2800 .2300 .2700 .1100 .1100 .2700 .2700 .2700 .2700 .2700 .2700	0.0000 0.0000 0.0000 0.3400 0.2400 0.22400 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00
2500 .2600 .2900 .2900 .2900 .2900 .2900 .2900 .2900 .2900 .2900 .2500 .2500 .2500 .2500 .2900 .2000 .2900 .2900 .2000 .	3200 3320 3320 3400 3100 2400 2400 2500 2700 2700 2700 2700 2700 2800 2600	.3300 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500 .3500	2200 3200 3200 3200 3200 3200 3200 3200	.1600 .2900 .2900 .3300 .3100 .3100 .3100 .1100 .2700 .2900 .2900 .2500 .3600	0.0000 .2800 .3400 .3400 .3400 .2200 .3000 0.0000 0.0000 0.0000 0.0000 0.2200 .2800 .2800
3200 .2900 .2800 .2800 .2800 .2800 .2800 .2800 .2800 .2500 .2500 .2500 .2700 .2700 .3400 .2700 .3600 .2700 .2500 .2500 .2500 .2900 .2500 .	3200 3400 3400 3100 2600 2600 2600 3200 3200 3200 2700 2200 2200	. 2600 . 3500 . 3500 . 3500 . 3500 . 3500 . 3200 . 3200 . 3200 . 3400 . 3400	2200 2300 2300 2800 2800 2800 2800 2800	.2900 .3300 .2500 .2500 .3100 .3100 .3100 .2700 .2700 .2500 .2500 .2500	2800 2700 3400 2700 2700 3400 3700 0000 0000 00000 00000 00000 11900 2800 2800
.3200 .2800 .2800 .2800 .2700 .2700 .2500 .2500 .3400 .3100 .3800 .3100 .3800 .2700	3900 3100 3100 2600 2600 2700 3200 3200 3200 2700 2700 2800 2800	. 3600 . 3900 . 3200 . 3200 . 3200 . 3200 . 3200 . 3200 . 3400 . 3600	23400 -2300 -2800 -2800 -2600 -2600 -3200 -3200 -3200 -3200 -3200 -3200 -3200 -3200 -3200 -3200 -3200 -3200 -3200 -3200 -3200	.2800 .3300 .2500 .3100 .3100 .1100 .2700 .2700 .2700 .2700 .2900 .2500	. 2700 . 3400 . 3400 . 3400 . 2400 . 2200 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
.2800 .2900 .2800 .2800 .2800 .2500 .2500 .2500 .3400 .2500 .2500 .2500 .2700 .2700 .2500	3400 3100 2400 2400 2900 3200 3200 2700 2700 2700 2700 2200 2600	. 3900 . 2700 . 2900 . 2900 . 2200 . 2200 . 2200 . 3200 . 3400 . 3000	2700 3800 2800 2800 0.0000 0.0000 3800 3800 3800 3800 38	.3300 .2500 .2500 .3100 .3300 .1100 .2700 .2700 .2800 .2800 .2900 .2900	. 3400 . 3400 . 2400 . 22400 . 2200 0. 0000 0. 0000 0. 0000 0. 0000 0. 2800 2800 2300
2800 .2800 .2800 .2700 .2500 .2500 .2500 .2500 .2500 .2700 .	3100 2400 2400 2900 2900 3200 3200 2300 2700 2200 2600	. 2700 . 3500 . 3600 . 3600 . 3500 . 3200 . 3200 . 3400	2300 2500 2500 2500 2500 3300 3300 3300	.2500 .3100 .3100 .3300 0.0000 .1100 .2700 .2700 .2800 .2500 .2500	.3400 .2400 .2200 .3000 0.0000 0.0000 0.0000 0.0000 .1900 .2800 .2800
2500 .3200 .3200 .2500 .2500 .3400 .3400 .2500 .2500 .3400 .3200 .2500 .3200 .3200 .2500 .3200 .2500 .	2600 2700 2700 2700 2700 2700 2800 2800 28	.3200 .3500 .3500 .3500 .3200 .3200 .3200 .3400	.3800 .2900 0.0000 0.0000 .3200 .3200 .3300 .3300 .3200	.2700 .3100 .3100 .0000 .0000 .1100 .2700 .2500 .2500 .2500 .2500	. 2400 . 3200 . 3200 0.0000 0.0000 0.0000 0.0000 0.0000 0.2200 2.2800
AFAY FIR I = 560 -2500 -3400 -3400 -31800 -35500 -35600 -3800 -3800 -3800 -3800 -3800 -3800 -3800 -3800 -3800 -3800 -36	2400 2400 3200 3200 2700 2700 2700 2200 2200	25,00 00,00 00,00 00,00 00,000	. 2800 0.0000 0.0000 0.2600 3200 3200 3300 3300 2500	.3100 .3300 .0000 .1100 .2700 .2800 .2500 .2500	. 2200 . 3000 0.0000 0.0000 0.0000 . 2200 . 1900 . 2800 . 2800
AFAY FIR I = 56 -2500 -3400 -2500 -2700 -2500 -3600 -3100 -3800 -3000 -2600 -2700 -2600 -2700 -2600 -3600 -2600 -3600 -2600 -3600 -2600 -3600 -2600 -3600	2900 2600 3200 3200 2700 2700 2700 2800 2600	.3600 0.0000 0.0000 0.2200 .3200 .3200 .3400	. 2900 0.0000 0.0000 . 2600 . 3200 . 2900 . 2500	. 3300 0.0000 0.0000 .1100 .2700 .2800 .2800 .2500 .2500	. 3000 0.0000 0.0000 0.0000 1.2200 2.2800 2.2800
AFFAY FR: I= 56 -1800 -2700 -2500 -3600 -3100 -3800 -3900 -2800 -2900 -2800 -2900 -2800 -3600 -5600 -3600 -5600 -3600 -6000 -3600 -6000 -3600 -1000 -1500 -1100	2200 2200 3200 3400 2700 2700 2200 2200	0.0000 0.0000 0.0000 0.2200 0.3200 0.3400 0.3600	0.0000 0.0000 .2600 .3200 .3300 .2700 .2500	0.0000 .1100 .2700 .2900 .2500 .3600	0.0000 0.0000 0.0000 0.0000 0.1900 0.2800 0.2800
1800 0.0000 0.2500 2500 3100 3800 3800 2800 2800 2800 2800 2800 3800 3	2600 3200 3400 2700 2700 2800 2200	0000.0 0000.0 0000.0 0000.0 0000.0 0000.0 0000.0 0000.0 0000.0	0.0000 0.0000 2.2600 .3200 .3300 .3300 .2500	0.0000 0.0000 .1100 .2700 .2800 .2800 .2500 .2500	0.0000 0.0000 0.2200 .1900 .2800 .2800
25500 .2700 .2700 .3800 .3800 .3800 .3800 .3800 .2800 .2800 .2700 .2500 .2500 .2500 .3600 .3600 .3600 .0600 .1100	2600 3200 3600 2700 2700 2700 2800 2200	0.0000 .2900 .3200 .2700 .3800	0.000 .2600 .3200 .3000 .2900 .2500	. 1100 . 1100 . 2700 . 2800 . 2500 . 2500 . 3600	0.0000 0.0000 0.0000 1.200 2.200 2.200
2600 .3600 .3800 .3800 .3800 .3800 .3800 .2600 .2500 .	3200 3600 2700 2700 2700 2800 2200	.2200 .3200 .2700 .3800	.2500 .3200 .3200 .2900 .3300 .2500	. 2900 . 2900 . 2900 . 2900 . 3600	2200 2200 2200 2200 2300 2300
.3100 .3800 .3800 .3300 .3300 .2800 .2800 .2600 .2600 .3100 .2500 .4000 .3100 .2500 .1000 .1100	3600 2700 2700 2700 2800 2200	.2200 .3200 .2700 .3400	.3200 .3000 .2900 .3300 .2500	. 2500 . 2500 . 2500 . 3600	. 2800 . 2800 . 2800 . 2800
.3300 .3000 .2700 .2800 .2700 .2500 .3400 .2500 .3100 .2700 .3100 .0000 .1500 .1100 .1500 .1100 .1500 .1100	2700 2700 2700 2800 2200 2600	.3200 .2700 .3400	. 2900 . 2900 . 3900 . 2500	2800 2800 2500 3600	2800 2800 2800 2800 2800
.2900 .2800 .2800 .2900 .2500 .2500 .2500 .2500 .2500 .4000 .2900 .2000	2700 2700 2800 2200 2600	.2700 .3800 .3400	.2900 .3300 .2500	.2800 .2500 .2500 .3600	2800
.3000 .2600 .3500 .3500 .3500 .3500 .2500 .2500 .3100 .2900 .1000 .1100	2700 2800 2200 2600	.3000	.3300 .2500 .2100	.2500 .2500 .2900 .3600	. 2300 . 2800 . 2300
.2700 .2500 .3600 .4000 .3100 .4000 .0600 .0000 .1400 .0600 .1500 .1000 .1200 .1100	2800 2200 2600	.3000	.2500	3600	.2800
.3600 .4000 .7000 .7000 .7000 .7000 .7000 .7000 .1000	2200	.3000	.2100	.3600	.2300
ARRAY FOR 1= 57 • 0600	2600	0000	0017.	.2500	. 2300
APEAN FOR 1 = 7.77 .0600 0.0000 0 .1400 .0600 .1500 .1000 .1200 .1100 .1400 .0700	0007	000	200) (
		0062.	0078.)	.2600
. 1100 . 0600 . 1100 . 0700 . 1100	0000				
.0600 .1100 .0700 .1100	0000	00000	00000	000000	000000
.1000 .0700 .1100	00700	00 10	000000	000000	00000
.1100 .0700 .1100	0080	.1000	• 0200	.0200	00000
.1100	.1000	•1200	.1300	.1100	.1100
.0900	1800	.1500	. 0800	.1500	.0700
0000	0200	.1300	.1400	.0700	.0800
0040.	.1000	.1100	•1100	.0800	.0700
0060*	• 0500	.0800	.0800	.1200	.1100
	1400	.1200	• 0600	.1000	.0700
.1200 .0600	1600	.1000	.1500	.1100	. 0600
OR I= 58					
0 0000 0	0.000	000000	000000	000000	0.0000
.1800	.0700	00000	000000	000000	0.000
.1400	0000	0060.	.1100	.0200	0.000
.0700	.1300	.1000	.0000	• 0800	. 0800
.1000	.0800	.1200	.1000	1100	0020
•1000	.1300	.1200	. 0400	.1200	.0500
.0800	.0300	0060.	0000.	.1000	.0700
.1300	.0700	.0500	0000	1600	0060
.0300	0070	0090	0020	00.51	1200
0200	1000	0090	0070	0000	0071
65 = [0000	0010.	00:00	0000.
0000.0	0000			000	

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

(PAGE 15 OF 17)

$0_0 0_0 0_0 0_0 0_0 0_0 0_0 0_0 0_0 0_0$	12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901
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		,	1500.0000 2000.0000 2500.0000 3000.0000 9000.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
		00000 •0	0.0000 0.0000 0.0000
		00000 00000	0.000 0.000 0.0000 0.0000
		0,000 0	9000.0000 .1800 .7300
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0100 0.0100 0.0000	. 5500 . 4000 . 3000 . 3000 . 1500 . 0500 0. 0000 0. 0	3000,0000 .1800 .7300
0.0000 0.0000 0.0000 0.0000 0.0100 0.0100 0.0100	0.0000 0.0000 0.0100 0.0100 0.0000 0.0000 0.0000	.9000 .8500 .6000 .7500 .7000 .0000 0.0000	2500,0000 .1700 .7400
0.0000 0.0000 0.0000 0.0000 0.0100 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	.8000 .7500 .7500 .6000 .6500 .6500 .4500 .4500 .2500 .2500 .1000 .0000	2000.0000 .1600 .7600 .0800
0.0000 0.0000 0.0000 0.0100 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	. 9500 . 9500 . 8500 . 7000 . 7000 . 5500 . 5500 . 5500 . 3500 . 3500 . 1000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1500.0000 .1500 .7800 .0700
. 0100 . 0200 0.0000 0.0000 . 0100 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	. 9500 . 8500 . 8500 . 7500 . 7500 . 5500 . 5500 . 4500 . 5000 . 0000 . 0000 . 0000 . 5000 . 5000	1000.0000 1 .1300 .8200 .0500
0.0000 .0200 .0100 .0200 .0100 .0100 0.0000	1 = 60 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	. 9900 . 9500 . 9500 . 8000 . 7500 . 6500 . 6500 . 6500 . 6500 . 6500 . 6500 . 6000 . 9000 . 9000	500,0000 1000,0000 .0700 .1300 .9000 .8200 .0300 .0500 20,0000 20,0000
0.0000 0.0200 0.0000 0.0000 0.0000 0.0100 0.0100	PE APRAY FOR 0,0000 0,0000 0,0100 0,0100 0,0000 0,0000	16 16 1000 500.000 1500.000 2500.000 2500.000 4000.000 4500.000 4500.000 5500.000 5500.000 650	

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

(PAGE 16 OF 17)

**************************************	****	****	* 2 3S1	HECK FOR CA	OF DATA	144444 EME	*******	****	***	****
				000000	.9750	.9750	.9750	.9150	181.0000	150.0000 2
0					75.0000	75.0000	75.0000		75.0000	75.0000
00	0.0000	174.0000	87.0000	52,0000	36.0000	24.0000	18.0000		5.0000	0.000
00			.8750		.6250	. 5000	.3750	• 2500	.1250	00000
			0.0000	0.000	00000	0000	0000		6	6
			46.3200	40.3200	0076.04	40.56.00	0041.00		00/1	0000
						0000	7001		40 1000	40.1000
			0.000	0.000	0.0000	000000	000000	0.0000	0.000	0.000
	12345678	234567890]	145678901	234567890123	T068) 4646	3400 (8407)	7069/06467	7060107467	T0 (0) 0 / 1 (3)	10/3/07/07
0012345470007334547000	12245470	2345478001	145478901	24567R9012	106879648	3426 (840)	73426783015	7069196467	TO 60/06+63	1043/00/4071

0011110 LINES PRINTED. (LS10) 0011110 LINES PRINTED. (LS10) SANDN4R Sandm4r ****

LISTING 7-2 LONG FORM OF ECHO PRINTS - CONT'D

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CHAPTER 8

8. PROGRAM DESIGN

8.1 Programming Principles of COPE.

The main COPE program has been designed according to the following principles:

- (1) Input is designed to allow multiple cases per run with only a few mnemonically keyed input lines per case. For flexibility, it is also possible to read in data as traditional FORTRAN formatted input.
- (2) Output is designed so that the printout of results is nearly self-explanatory. In addition, user generated comments can easily be made to appear in the printout for any case.
- (3) The program is highly modularized. The main program consists almost entirely of calls to various subroutines together with the logic necessary to initialize and control the execution of three nested loops (see section 8.2).
- (4) Most subroutines or functions are designed for a single purpose (e.g., perform a test, read input, write output, etc.) so that when one wishes to change any aspect of the program it is usually necessary to change only a small number of the subroutines (usually the one performing a particular test plus the input routine).
- (5) The principles of structured programming have been adhered to in some degree. Because the program is written in FORTRAN IV (extended CDC version) which does not have if-then-else, do-until, do-while constructs, it is still necessary to use GO TO's and statement labels. However, blank comment cards have been inserted between logical blocks within each program to improve readability, and unnecessary GO TO's have been minimized. In addition, statement labels are in ascending numerical order within each subroutine.
- (6) All data statements have been grouped into a single BLOCK DATA subprogram.
- (7) Mnemonically meaningful variable and subroutine names have been selected.
- (8) FORTRAN code has been written to minimize the number of nonstandard (i.e., CDC peculiar) features used. Nevertheless, there are some CDC peculiar code features that were impractical to omit (e.g., READMS, SYSTEMC, etc.). These are cited in Chapter 13.

8.2 General Logic Flow.

The COPE main program can be viewed as three large nested loops on case, replication, and round. Figure 8-1 illustrates the general COPE logic flow including the three loops.

This figure is necessarily oversimplified and a more detailed flow chart is to be found in Chapter 11, but the overall picture is accurately summed up here.

8.3 Subroutine and Function Calling.

Table 8-2 gives a listing of the names of the main program, all of the subroutines, and all of the functions in the COPE program.

COPE is the main program name.

FPRCNT, GAMMA, IDCHAR, NUMRIC, and URAN31 are the function names.

ABRTTL, ADDTBR, ADDTOF, ARTCHK, BLOCHK, CCPLOT, COMMNT, CREAD, DETCTN, DFAULT, DFCHK, DUST, ECHO, FINDIT, GETRNG, GETTIM, GETVIS, HEADER, HITCHK, INITLZ, INPUT, LOSCHK, MINTRN, NOREC, OUTPUT, PECHK, PENAME, PKCHK, PPLOT, PSMOKE, REINTZ, RNDREL, RNGCHK, SEPREC, SMOKE, SMPLCD, TIMCHK, TITLE, USET, VISCHK, and WARNFO are the subroutine names.

PEIDNT is an entry point name in subroutine PENAME.

For each list entry (subprogram name) in Table 8-2, there are sections giving the names of subprograms calling the given list entry, the names of subprograms (in COPE) that the given list entry calls, and the names of system or IMSL routines that the given list entry calls.

There is a discrepany that occurs in the list. Subroutine NOREC is called by system routines LOCF (as an external argument) and SYSTEMC (by address loaded in IRAY array) and hence does not show as "CALLED BY" any routine in Figure 8-2 (see section 9.31).

Table 8-3 lists the system (CDC, standard FORTRAN, and International Mathematical and Statistical Library) routines used in COPE and the subprograms of COPE that call each of them.

Table 8-4 is a subprogram calling tree. Each subprogram (subroutine or function) in column two can be called by the COPE main program directly. Each subprogram in column N calls those subprograms in column N+1 to which it is linked by lines (V's, I's, -'s, and >'s).

NOREC calls no other subprograms in COPE. It is called by SYSTEMC whenever CDC FORTRAN IV Extended execution error 104 is encountered in INPUT, INITLZ, or FINDIT.

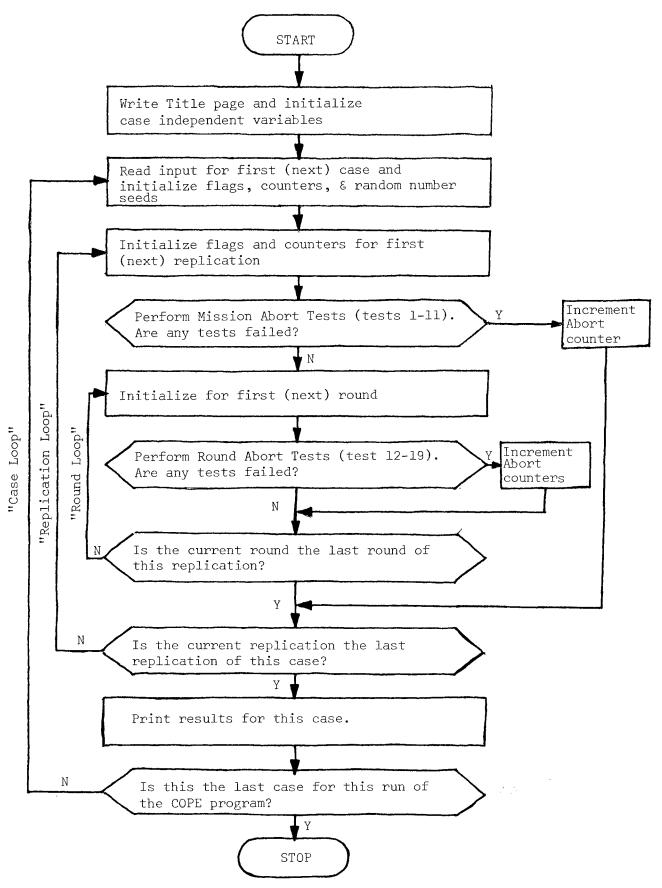


FIGURE 8-1 General COPE Logic Flow

TABLE 8-2 PROGRAM UNIT REFERENCES (SUBROUTINES, FUNCTIONS, AND MAIN PROGRAM)

ABRTTL.	CALLED BY	ARTCHK HITCHK RNGCHK	BLOCHK LOSCHK SMOKE	DETOTM MINTRN TIMCHK	DFCHK PECHK VISCHK	DUST PKCHK WARNDO	GETTIM RNDREL
ADDTER	CALLED BY	COPE					
ADDTOF	CALLED BY	COPE					
ARTCHK	CALLED BY CALLS	COPE ABRTTL	URAN31				
BLOCHK	CALLED BY CALLS	COPE ABRITL					
CCPLOT	CALLED BY CALLS CALLS (SYS)	INPUT COMMNT ENCODE					
COMMNT	CALLED BY CALLS (SYS)	CCPLOT ENCODE	HEADER WRITE	INPUT	PPLOT	SEPREC	
COPE	CALLS	ADDTER DUST INPUT REINTZ VISCHK	ADDTOF GETRNG LOSCHK RNDREL WARNDO	ARTCHK GETTIM MINTRN RNGCHK	BLOCHK GETVIS OUTPUT SMOKE	DETCIN HITCHK PECHK TIMCHK	DECHK INITUZ PKCHK TITLE
CREAD	CALLED BY CALLS CALLS (SYS)	INPUT SEPREC DECODE	ENCODE	READ			
DETCTN	CALLED BY CALLS	COPE ABRITL	SMPLOD				
DEAULT	CALLED BY	INITLZ					
DECHK	CALLED BY CALLS CALLS (SYS)	COPE ABRITL AMAX1	URAN31				
BUST	CALLED BY CALLS	COPE ABRITL	URAN31				
ECHO	CALLED BY CALLS (SYS)	INPUT WRITE					
FINDIT	CALLED BY CALLS CALLS (SYS)	INPUT NUMRIC IFIX	LOCF	READMS	SYSTEMC	WRITE	
FPRONT	CALLED BY CALLS (SYS)	OUTPUT ENCODE					
GAMMA	CALLED BY CALLS (IMSL)	GETTIM GGAMA					

TABLE 8-2 PROGRAM UNIT REFERENCES (SUBROUTINES, FUNCTIONS, AND MAIN PROGRAM) - CONT'D

GETRNG	CALLED BY CALLS CALLS (SYS)	COPE SMPLCD FLOAT	STRACE				
GETTIM	CALLED BY CALLS	COPE ABRTTL	GAMMA	SMPLCD	URAN31		
GETVIS	CALLED BY CALLS CALLS (SYS)	COPE URAN31 STRACE					
HEADER	CALLED BY CALLS CALLS (SYS)	INPUT COMMNT DECODE	PEIDNT ENCODE	WRITE			
нітснк	CALLED BY CALLS	COPE ABRITL	URAN31				
IDCHAR	CALLED BY	NUMRIC	SEPREC				
INITLZ	CALLED BY CALLS CALLS (SYS)	COPE DFAULT LOCF	USET OPENMS	READMS	SYSTEMC		
INPUT	CALLED BY CALLS	COPE CCPLOT PENAME	COMMNT PPLOT	CREAD PSMOKE	ECHO SEPREC	FINDIT USET	HEADER
	CALLS (SYS)	ABS READMS	DECODE READ	ENCODE SYSTEMC	EDF WRITE	FLOAT	LOCF
LOSCHK	CALLED BY CALLS CALLS (SYS)	COPE ABRTTL AMAX1	URAN31				
MINTRN	CALLED BY CALLS CALLS (SYS)	COPE ABRTTL AMAX1	URAN31				
NOREC	CALLED BY CALLS (SYS)	STRACE	WRITE				
NUMRIC	CALLED BY CALLS CALLS (SYS)	FINDIT IDCHAR DECODE	ENCODE	WRITE			
τυզτυο	CALLED BY CALLS CALLS (SYS)	COPE FPRCNT FLOAT	WRITE				
PECHK	CALLED BY CALLS CALLS (SYS)	COPE ABRTTL AMAX1	URAN31 FLOAT	MAXØ	MINØ	MIN1	
PEIDNT	CALLED BY CALLS (SYS)	HEADER ABS	DECODE	FLOAT	аом		
PENAME	CALLED BY CALLS (SYS)	INPUT ABS	ENCODE				

TABLE 8-2 PROGRAM UNIT REFERENCES (SUBROUTINES, FUNCTIONS, AND MAIN PROGRAM) - CONT'D

PKCHK CALLED BY COPE CALLS (SYS) MINE PPLOT CALLS (SYS) INPUT COMMINT CALLS (SYS) ENCODE PSMOKE CALLED BY CALLED BY CALLED BY CALLS (SYS) MOD WRITE RNDREL CALLED BY COPE CALLED BY CALLS (SYS) MOD WRITE RNDREL CALLED BY COPE CALLS (SYS) STRACE WRITE TIMCHK CALLED BY COPE CALLS (SYS) STRACE WRITE TITLE CALLED BY COPE CALLS (SYS) DATE TIME WRITE URAN31 CALLED BY COPE CALLS (SYS) COPE CALLS					0, 10110110	 1211 1 1 1 0 0 1 1 1	
CALLS (SYS) COMMNT ENCODE PSMOKE CALLED BY CALLED BY CALLED BY CALLS (SYS) MOD WRITE RNDREL CALLED BY COPE ABRITL URAN31 RNGCHK CALLED BY COPE ABRITL SEPREC CALLED BY COMMNT IDCHAR ENCODE SMOKE CALLED BY CALLS URAN31 SMPLOD CALLED BY CALLS URAN31 SMPLOD CALLED BY CALLS URAN31 TIMCHK CALLED BY CALLS URAN31 TITLE CALLED BY COPE ABRITL TITLE CALLED BY COPE ABRITL URAN31 TITLE CALLED BY COPE ABRITL URAN31 TITLE CALLED BY COPE ABRITL URAN31 CALLED BY COPE ABRITL TIMCHK CALLED BY COPE ABRITL TITLE CALLED BY COPE ABRITL URAN31 CALLED BY COPE ABRITL TIMCHK CALLED BY COPE ABRITL TITLE CALLED BY COPE ABRITL URAN31 CALLED BY ARTCHK DECK MARNDO USET CALLED BY COPE VISCHK CALLED BY COPE VISCHK CALLED BY COPE	PKCHK	CALLS	ABRTTL	URAN31			
REINTZ CALLED BY COPE WRITE RNDREL CALLED BY COPE ABRITL URAN31 RNGCHK CALLED BY COPE ABRITL URAN31 SEPREC CALLED BY COMMINITY CALLED BY CALLS (SYS) SMOKE CALLED BY COPE ABRITL URAN31 SMPLOD CALLED BY COPE ABRITL URAN31 TIMCHK CALLED BY COPE ABRITL TITLE CALLED BY COPE ABRITL URAN31 TITLE CALLED BY COPE ABRITL URAN31 CALLED BY COPE ABRITL TITLE CALLED BY COPE ABRITL URAN31 CALLED BY COPE ABRITL TITLE CALLED BY COPE ABRITL URAN31 CALLED BY COPE ABRITL URAN31 CALLED BY COPE ABRITL TITLE CALLED BY COPE ABRITL URAN31 CALLED BY INITLZ INPUT VISCHK CALLED BY COPE	PPLOT	CALLS	COMMNT				
RNDREL CALLED BY COPE CALLS CALLED BY COPE CALLS CALLED BY CALLED BY CALLS CALLED BY CALLED BY CALLS CALLED BY COPE USET CALLED BY INITIZ INPUT VISCHK CALLED BY COPE	PSMOKE			FLOAT			
RNGCHK CALLED BY COPE ABRITL URAN31 SEPREC CALLED BY COMMNT IDCHAR CALLS (SYS) COMMNT IDCHAR CALLS (SYS) COPE ABRITL URAN31 SMOKE CALLED BY CALLS URAN31 SMPLCD CALLED BY CALLS (SYS) STRACE WRITE TIMCHK CALLED BY COPE ABRITL URAN31 TITLE CALLED BY COPE DATE TIME WRITE URAN31 CALLED BY LOSCHK MINTRN PECHK PKCHK RNDREL SMOKE SMOKE USET CALLED BY INITLZ INPUT	REINTZ			WRITE			
SEPREC CALLED BY CREAD INPUT IDCHAR CALLS (SYS) ENCODE SMOKE CALLED BY CALLS (SYS) ENCODE SMOKE CALLED BY CALLS (SYS) STRACE WRITE TIMCHK CALLED BY COPE ABRITL WRITE TITLE CALLED BY COPE ABRITL WRITE URAN31 CALLED BY COPE TIME WRITE URAN31 CALLED BY ARTCHK DFCHK DUST GETTIM GETVIS HITCHE SMOKE SMPLCD WARNDO USET CALLED BY COPE VISCHK CALLED BY COPE	RNDREL			URAN31			
CALLS (SYS) COMMNT IDCHAR SMOKE CALLED BY COPE CALLS BY BETCTN GETRNG GETTIM CALLS (SYS) STRACE WRITE TIMCHK CALLED BY COPE CALLS (SYS) DATE TITLE CALLED BY COPE CALLS (SYS) DATE TIME WRITE URAN31 CALLED BY COPE CALLS (SYS) DATE TIME WRITE URAN31 CALLED BY COPE CALLS (SYS) DATE TIME WRITE URAN31 CALLED BY ARTCHK DECHK DUST GETTIM GETVIS HITCHE SMOKE USET CALLED BY INITLZ INPUT VISCHK CALLED BY COPE	RNGCHK						
SMPLCD CALLED BY DETCTN GETRNG GETTIM URAN31 WRITE TIMCHK CALLED BY COPE ABRITL TITLE CALLED BY COPE CALLS (SYS) DATE TIME WRITE URAN31 CALLED BY ARTCHK DECHK BUST GETTIM GETVIS HITCHE SMPLCD WARNDO USET CALLED BY INITLZ INPUT VISCHK CALLED BY COPE	SEPREC	CALLS	COMMNT				
CALLS (SYS) STRACE WRITE TIMCHK CALLED BY COPE ABRITL TITLE CALLED BY COPE TIME WRITE URAN31 CALLED BY ARTCHK DFCHK DUST GETTIM GETVIS HITCHE LOSCHK MINTRN PECHK PKCHK RNDREL SMOKE USET CALLED BY INITLZ INPUT VISCHK CALLED BY COPE	SMOKE			URAN31			
TITLE CALLED BY COPE TIME WRITE URAN31 CALLED BY ARTCHK DFCHK DUST GETTIM GETVIS HITCH- LOSCHK MINTRN PECHK PKCHK RNDREL SMOKE USET CALLED BY INITLZ INPUT VISCHK CALLED BY COPE	SMPLCD	CALLS	URAN31		GETTIM		
URAN31 CALLED BY ARTCHK DFCHK BUST GETTIM GETVIS HITCHE SMOKE USET CALLED BY INITLZ INPUT VISCHK CALLED BY COPE	TIMCHK						
LOSCHK MINTRN PECHK PKCHK RNDREL SMOKE SMPLCD WARNDO USET CALLED BY INITLZ INPUT VISCHK CALLED BY COPE	TITLE			TIME	WRITE		
VISCHK CALLED BY COPE	URAN31	CALLED BY	LOSCHK	MINTRN			HITCHK SMOKE
	USET	CALLED BY	INITLZ	IMPUT			
	VISCHK						
WARNDO CALLED BY COPE CALLS ABRITL URANGI	WARNDO			UPAN91			

TABLE 8-3 SYSTEM AND IMSL ROUTINE REFERENCES

ABS	CALLED BY	INPUT	PEIDNT	PENAME			
AMAXI	CALLED BY	DECHK	LOSCHK	MINTRN	PECHK		
AMIN1	CALLED BY	PSMOKE					
DATE	CALLED BY	TITLE					
DECODE	CALLED BY	CREAD	HEADER	INPUT	NUMRIC	PEIDNT	
ENCODE	CALLED BY	CCPLOT NUMRIC	COMMNT PENAME	CREAD PPLOT	FPRONT SEPREC	HEADER	INPUT
EOF	CALLED BY	INFUT					
FLOAT	CALLED BY	GETRNG	INPUT	OUTPUT	PECHK	PEIDNT	PSMOKE
GGAMA	CALLED BY	GAMMA					
IFIX	CALLED BY	FINDIT					
LOCF	CALLED BY	FINDIT	TNITLZ	INPUT			
MAXØ	CALLED BY	PECHK					
MING	CALLED BY	PECHK	PKCHK				
MINI	CALLED BY	PECHK					
мов	CALLED BY	PEIDNT	REINTZ				
OPENMS	CALLED BY	INITLZ					
READMS	CALLED BY	FINDIT	INITLZ	INPUT			
READ	CALLED BY	CREAD	INPUT				
STRACE	CALLED BY	GETRNG	GETVIS	NOREC	SMPLCD		
SYSTEMO	CALLED BY	FINDIT	INITLZ	IMPUT			
TIME	CALLED BY	TITLE					
WRITE	CALLED BY	COMMNT NUMRIC	ECHO OUTPUT	FINDIT REINTZ	HEADER SMPLCD	INPUT	NOREC

NOTE: ALL ROUTINES LISTED IN THE FIRST COLUMN OF THIS TABLE (EXCEPT GGAMA) ARE STANDARD SYSTEM ROUTINES OF CDC FORTRAN EXTENDED VERSION 4.
GGAMA IS A SUBROUTINE FROM THE INTERNATIONAL MATHEMATICAL AND STATISTICAL LIBRARY (IMSL).

TABLE 8-4 COPE SUBROUTINE "TREE"

```
COPE----->ADDTBR
   I---->ADDTOF
     ---->ARTCHK---->ABRTTL
                 I---->URAN31
   I---->BLOCHK---->ABRTTL
   I----->DETCTN----->ABRTTL
                 I---->SMPLCD---->URAN31
   I---->DFCHK----->ABRTTL
                I---->URAN31
     ---->DUST---->ABRTTL
               I---->URAN31
   I---->GETRNG---->SMPLCD---->URAN31
     ----->GETTIM---->ABRTTL
                 I---->GAMMA
                 I---->SMFLCD---->URAN31
   ٧
                 I---->URANG1
   I---->GETVIS---->URAN31
      ---->HITCHK---->ABRTTL
                 I---->URAN31
     ----->INITLZ---->DFAULT
                 I---->USET
     ----->INPUT----->CCPLOT----->COMMNT
                I---->COMMNT
                I---->CREAD----->SEPREC---->COMMNT
   V
                                         I---->IDCHAR
   V
                I---->ECHO
   ٧
                I---->FINDIT----->NUMRIC----->IDCHAR
   Ų
                I---->HEADER---->COMMNT
   V
                             I---->PEIDNT
   V
                 ----->PENAME
   ٧
                 ---->PPLOT---->COMMNT
   V
                I---->PSMOKE
   IJ
                I---->SEPREC---->COMMNT
                             I---->IDCHAR
                I---->USET
      ---->LOSCHK---->ABRTTL
                 I---->URAN31
     ---->MINTRN---->ABRTTL
                 I---->URAN31
     ---->OUTPUT---->FPRCNT
      ---->PECHK----->ABRTTL
                I---->URAN31
     ---->PKCHK----->ABRTTL
                I---->URAN31
   I----->REINTZ
   I---->RNDREL---->ABRTTL
                 I----->URAN31
   I----->RNGCHK---->ABRTTL
      ---->SMOKE---->ABRTTL
                I---->URAN31
      ---->TIMCHK---->ABRTTL
     ---->TITLE
    I---->VISCHK---->ABRTTL
     ---->WARNDO---->ABRTTL
                 I----->URAN31
NOREC
```

SUBPROGRAMS

This chapter explains in moderate detail what each subprogram of COPE does. All four standard FORTRAN subprogram types (main program, block data, function, and subroutine) are present in COPE. In the following, the subprograms are discussed in this order: main program, block data, functions (in alphabetical order), and subroutines (in alphabetical order).

This chapter deals only with subprograms defined by COPE. System subroutines and functions are divided into three classes: standard FORTRAN IV routines, routines peculiar to CDC FORTRAN 4 Extended, and IMSL routines. The reader is assumed to be familiar with the first of these classes (or at least have access to a FORTRAN manual). System routines in the remaining two classes are discussed to some extent in Chapter 13.

9.1 COPE Main Program.

The COPE main program is well summarized by the flowchart in Figure 8-1.

The main program begins by calling routines that write the title page (TITLE) and initialize case independent variables (INITLZ).

Next the main program calls INPUT to read the first (or next) case's input. It then calls REINTZ which re-initializes certain case dependent counters and random number seeds. It then initializes the current replication number at one and the number of FO's (DO's) killed so far in the case at zero. The steps in this paragraph begin the "case loop."

The main program next begins the "replication loop" for the first (or next) replication of the current case. This loop begins by initializing the number of the current round to one and then setting various times, flags, and a counter.

The "replication loop" now continues by calling a sequence of subroutines which perform the tests described in Chapter 2 and sample weather, range-LOS, and time data.

routines (in order called) purpose ARTCHK perform test 1 **GETVIS** sample weather distribution **GETRNG** sample acquisition range and LOS segment distributions perform test 2 VISCHK perform test 3 RNGCHK perform test 4 DETCTN perform test 5 SMOKE DUST perform test 6 perform test 7 BLOCHK sample time distribution(s) **GETTIM** and perform tests 8 and 9 BLOCHK perform test 10 TIMCHK perform test 11 (for "shootting gallery" only) **ADDTOF** calculate round arrival time

Each of these routines is explained in detail later in this chapter.

Note that if any routine that performs one (or more) of the tests is called and the test is failed, then the subsequent routines in the above list are not called; instead, control transfers to statement 140 (end of "replication loop") where a check is made to determine whether all of the replications for this case have been done. If they have, OUTPUT is called to print case results and then the end of the "case loop" is either hit and control returns to statement 100 which calls INPUT to read the input for the next case or, if the last case has been run, control passes to the STOP and the program terminates. If not all replications for the current case have been completed, then the number of the current replication is increased by one and control returns to statement 110 (which is the start of the "replication loop") to begin next replication.

If none of the tests are failed and the program reaches ADDTOF on the current replication, then the "round loop" begins (with statement 120). The "round loop" consists of a further sequence of subroutines which are called to perform those tests that may affect only one round.

routines(in order called)	purpose
LOSCHK	perform test 12
WARNFO	perform test 13
DFCHK	perform test 14
RNDREL	perform test 15
MINTRN	perform test 16
PECHK	perform test 17
HITCHK	perform test 18
PKCHK	perform test 19

Again, each of these routines is explained in detail later in this chapter.

If any subroutine that performs one of these tests (12 through 19) is called and the test is failed, then the subsequent routines in the above list are not called for the current round; instead, control transfers to statement 130 (end of "round loop") where a check is made to determine whether all of the rounds for this replication have been done. If they have, control transfers to statement 140 (end of "replication loop") where the check is made to determine whether more replications are to be done for the current case. If not all rounds for this replication have been completed, then the time the next round arrives is computed (ADDTBR), the round number is incremented by one, the end replication (or ENDREP) flag is reset and control transfers to statement 120 (start of "round loop") to begin the next round.

If no test is failed, then control reaches statement 130 after the entire sequence of subroutines in the "round loop" has been called. At this point a check is made to determine whether all rounds for this replication have been done. Control then proceeds just as in the case when statement 130 is reached due to a failed test as described in the paragraph above.

When all the rounds for a replication are completed, a check is made to determine whether more replications remain to be done (end of "replication loop"). If more replications remain, control transfers to 110 (start of "replication loop") to begin the next replication. If all replications for the current case are completed, then OUTPUT is called to print results for current case (end of "case loop").

When a case ends and its results are printed, the program checks whether the last case flag (ENDFLG) has been set. If it has, the program stops; if it has not been set, then control goes to statement 100 and INPUT is called to read the next cases input. If there is input for another case, it is read and the entire process from INPUT through end of "case loop" is repeated; if there is no input for further cases, the program terminates.

9.2 BDATA1 Block Data Subprogram.

BDATA1 consists entirely of data statements used to initialize variables in various COMMON blocks. These blocks are listed in section 4.7 and are their variables defined individually in Chapter 12 (Glossary of Variables).

9.3 FPRCNT Function.

This function formats percentages. It takes a numerical argument XIN and a logical argument PAREN and assigns a one word alphanumeric character string as the value of FPRCNT.

If XIN is negative, then FPRCNT is assigned: the left justified character string $\underline{\text{UNDEF}}$, when PAREN is true; the right justified character string $\underline{\text{UNDEF}}$, when PAREN is false.

If XIN \geq 100.05, a STOP occurs with an error message (see section 7.5.7).

 $\,$ If XIN is positive and less than 100.05, then FPRCNT is assigned:

a left justified character string of the form X.XX%, XX.XX%), or 100.0%), when PAREN is true;

a right justified character string of the form X.XX%, XX.XX%, or 100.0%, when PAREN is false.

The character strings created by FPRCNT are used by OUTPUT to print percentages. FPRCNT is called only from OUTPUT.

9.4 GAMMA Function.

This function takes two arguments, one real parameter ALPHA and one integer IRN, and returns a real value as GAMMA.

ALPHA is the α -parameter of the gamma distribution's probability density function:

$$g(x) = \frac{1}{\Gamma(\alpha)} \chi^{\alpha-1} e^{-x}$$

GAMMA is assigned a value obtained by randomly sampling from the above distribution. This sampling is accomplished by calling the IMSL subroutine GGAMA with random number seed IRN.

The function GAMMA itself then really does nothing more than dimension two arrays required by GGAMA, define an additional variable used by GGAMA, call GGAMA with ALPHA, IRN, the two arrays and the additional variable as arguments, and then set GAMMA equal to the random sample obtained by GGAMA from the gamma distribution.

9.5 IDCHAR Function.

The IDCHAR function takes three arguments, one real array A and two integer variables N and I. It returns an integer value.

The array A of dimension N should be filled with left justified characters, one character per word. (Most often A is dimensioned with N=80 and consists of a card image read under 80Al Format in INPUT). The function IDCHAR then examines the Ith element of the array, that is A(I).

The function IDCHAR is then assigned a value as follows:

```
IDCHAR = 0 if A(I) is a number or minus sign (hyphen);
IDCHAR = 1 if A(I) is a letter or an apostrophe;
IDCHAR = 2 if A(I) is a decimal point (period);
IDCHAR = 3 if A(I) is a blank;
IDCHAR = 4 if A(I) is a separator (i.e., a comma, a left or right parenthesis, a slash, or a question mark);
IDCHAR = 5 if A(I) is a dollar sign; and
IDCHAR = 6 if A(I) is anything else.
```

9.6 NUMRIC Function (Logical Valued).

The NUMRIC function takes one real array argument, B, and three integer variable arguments N1, N2, and IB.

The array B of dimension N1 by N2 (i.e., DIMENSION B(N1, N2)) is checked to determine whether its IBth line (that is, entries B(J, IB) for $J=1, 2, 3, \ldots, N2$) is numeric data (i.e., whether it consists only of numerals, minus sign, and decimal point possibly with trailing blanks).

If the line is numeric data, NUMRIC is assigned the value TRUE. If the line contains some non-numeric characters (letters, commas, etc.), then NUMRIC is assigned the value FALSE.

The IBth line of the B array is treated as a left justified character string (10 characters per word) which is examined character by character. Only the first 80 characters of the line are examined.

When the line being checked meets certain special conditions, other actions may be taken: If more than one decimal point is encountered, an error stop with message occurs. If no decimal point is encountered but the characters are otherwise numeric data, then a decimal point is added to B at the end of the non-blank characters, NUMRIC is assigned the value TRUE, and a return occurs. If the data are numeric but consist of more than ten non-blank characters (including the added decimal point, if any), then an error stop with message occurs. If the data contain imbedded blanks, then checking stops at the first imbedded (i.e., non-trailing) blank and the program behaves as though every character following were a blank. (This should have no effect in practice since the only imbedded blanks occur in PEDATA record names entered with the \$ preceding them. Those names will already have failed the numeric test before ever reaching their first imbedded blanks).

9.7 URAN31 Function.

This function takes one integer argument I and returns a real value between 0 and 1 (exclusive).

This is the "random" number generator used to sample most COPE data and to generate "random" numbers to be compared against probabilities to determine whether various tests are passed.

The best results are obtained when I is an odd integer in the range from 0 to 67108864. URAN31 generates a sequence of "random" numbers by replacing I by $3125*I(MOD\ 67108864)$ and then setting URAN31 equal to I divided by 67108864. (That is, a linear congruential type random number generator $A(N+1) = A(N)*B(MOD\ C)$ where B=3125 and C=2**26). Then repeating the process with the new value of I gives the next "random" number.

The function is written so that overflow will not occur even on machines with a word size as small as 32 bits.

Normally, one would not define the random number generator explicitly in the program code since one is available on nearly every computer as a standard system function. However, because users on other machines may wish to run the sample cases (see appendices) to check for correct implementation, the URAN31 function has been built into COPE as its standard (system independent) random number generator.

9.8 ABRTTL Subroutine.

This subroutine takes the integer argument IABRT which is the number of the test whose failure caused ABRTTL to be called.

ABRTTL updates the test abort total array NABORT by increasing the proper entry of the NABORT array by one. For mission aborts, the elements corresponding to all rounds of the IABRTth test are increased; for round aborts, only the element corresponding to the IABRTth test and current (KRFth) round is increased.

In addition, the flag ENDREP is set to TRUE to indicate that a test has been failed and the current replication (or round) need not continue through the subsequent tests.

9.9 ADDTBR Subroutine.

This subroutine adds TBR (time between rounds) to TIMRA (time round arrived) to obtain the new value for TIMRA (time next round arrives).

9.10 ADDTOF Subroutine.

This subroutine adds TOF (time of flight) to TIMNOW (time gun is ready to fire Copperhead) to obtain the TIMRA (time first round arrives).

9.11 ARTCHK Subroutine.

This subroutine performs the test to determine whether the FO (or DO, designator operator) has been killed or suppressed by RED preparatory artillery fires on this replication.

9.12 BLOCHK Subroutine.

This subroutine performs the bail out checks (tests 7 and 10).

9.13 CCPLOT Subroutine.

This subroutine would produce a Cal-Comp plot of case results, if implemented. At the present time it merely produces a comment that no plot was produced for the case.

9.14 COMMNT Subroutine.

This subroutine takes four arguments: one real array A containing the character string that is the comment, one integer N1 which is the dimension of A, and two logical flags that indicate whether the comment is a user comment and whether the comment is a program generated "\$\$\$" comment.

The subroutine writes the comment immediately (along with a "\$\$\$" comment page heading, if needed) if the comment is a "\$\$\$" comment (either user or program generated). If the comment is a "\$\$" comment, then it is encoded into the CMENT array for later printing with the current case. If the comment is a "\$" comment, it is ignored and a return occurs.

Note that user comments are in format 80A1 with DIMENSION A (80) whereas program generated comments are in format 8A10 with DIMENSION A(10). This difference need not concern the casual user, but is required knowledge if one is to modify the program in so far as comments are concerned.

9.15 CREAD Subroutine.

This subroutine is called by INPUT whenever the user exercises the temporary option. The second field on the $\overline{\text{TEMPORARY}}$ card will be used by subroutine INPUT to set the value of IT2 equal to the keyword number for which the temporary option is being used.

CREAD then sets ITYPE equal to IT2-20 and executes a computed GO TO on ITYPE. As a result of this computed GO TO, control transfers to one of eight sections where the formatted temporary data is read. Each of these sections corresponds to one of the eight data blocks and each consists mainly of READ statements that fill in that data block's variables. When the reading is completed, control branches to statement number 410 where a return occurs.

9.16 DETCTN Subroutine.

This subroutine samples the detection time distribution to obtain the detection delay time for this replication (i.e., time from unmask until D.O. initiates call for fire. It includes detection, acquisition, and decision time).

If "random occurrence" is being played, control returns. If "shooting gallery" is being played, the detection delay time is compared with the line of sight duration (test 4). If the test is passed, a return occurs; if the test is failed the abort totaller is called (ABRTTL) prior to the return.

9.17 DFAULT Subroutine.

This routine merely sets the default values for many of the case descriptor parameters, data block record names, and flags. (It could really be replaced by some data statements to fill in these same variables if one so desires).

9.18 DFCHK Subroutine.

This subroutine performs test 14. If the FO (DO) has been killed on a previous call for the current replication, control transfers to 120 where the round abort is totalled (call to ABRTTL) followed by a return.

Otherwise, the routine calculates the current designator-to-target range. Then it uses that range value to interpolate in the DFFOKL array to obtain probability that direct fire kills the DO and probability that direct fire obscures but does not kill the DO. When these probabilities are obtained, test 14 is performed to determine whether the DO is unaffected, obscured but not killed, or killed. If the DO is unaffected, the routine returns; if the DO is obscured but not killed, the routine calls ABRTTL to increment the round abort counter and then returns; and, if the DO is killed, the routine increments the DO killed counter, sets the DO killed flag, then calls ABRTTL and returns.

9.19 DUST Subroutine.

This subroutine performs test 6 and calls ABRTTL if the test is failed.

9.20 ECHO Subroutine.

This subroutine takes the integer argument IUNIT. IUNIT is the logical I/o unit to which ECHO will write. (IUNIT = 8 currently)

Subroutine ECHO does nothing more than write out the current values of the parameters, flags, arrays, etc. that describe the conditions of the case. (see section 7.6) This printout is provided primarily as a debugging aid.

9.21 FINDIT Subroutine.

This subroutine takes a real array B of character strings dimensioned N1 by N2 and returns an integer valued array IT dimensioned N3. Normally N1 = 8, N2 = 10, and N3 = 10 so we have

DIMENSION B(8, 10), IT (10). The Kth line of B (i.e., B(J,K) for J = 1,2,3,...,8 with K fixed) consists of the character string found in the Kth field of the input card just read. This character string is compressed by eliminating blanks (the exception is that blanks occurring in PEDATA record names preceded by \$ are preserved when moved into the B array) and packing the results 10 characters per word into B.

Subroutine FINDIT compares the first line of the B array (B(1,1) through B(8,1)) with the keywords in the CHAR array in an attempt to find a match. If not successful, an error message and error stop occur; if a match is found, then IT(1) is set to the keyword number (contained in CHAR array also).

Next, if the match occurred with the TEMPORARY, OVERRIDE, or RESET keywords, then a second pass through the keyword list (CHAR array) is made to find a match with the second line of the B array. If this search is successful, IT(2) is set to the value of the matched keyword and a return occurs. If unsuccessful, an error message and stop occurs. An error message and stop also occur if a match is found for a keyword that is not allowed with TEMPORARY, OVERRIDE, or RESET.

If the first match was not with TEMPORARY, OVERRIDE, or RESET, then the routines checks CHAR (2, IMATCH) to see how many option word character strings are allowed with the IT(1)th keyword. If this number is zero, that is the flag to the program that it may have one of the keywords that takes only numerical values and so control transfers to statement 210. At statement 210, B(1,2) is checked. If B(1,2) is blank, a return occurs; if B(1,2) is numeric data, IT(2) is set to zero; if B(1,2) is neither blank nor numeric an error print occurs. Note that the blank occurs either when the keyword has no optionwords allowed (as with FIRST CASE, END, etc.) or when the keyword is omitted (i.e., the default valued is desired).

If CHAR(2, IMATCH) is non-zero, it gives the number of different option word character strings allowed with the current card's keyword. The TAPE 11 record name is then set to the abbreviated form of the keyword and the record of option word character strings allowed with the keyword is read into the CHARA array. The program then proceeds to match B(2,1) through B(2,8) with allowable option word choices for option word 1, B(3,1) through B(3,8) with allowable choices for option word 2, etc. If a match is not found for any line of B, then it is tested to see whether it is numeric; if not, an error message and stop occur, if it is numeric, the next line of B is checked. If line K of B is numeric, IT(K) is set to zero; if line K of B is blank, IT(K) is left at one (the value indicating default) to which it was set near the beginning of FINDIT; if line K of B matches one of the character strings allowed for option word K-1, then IT(K) is set equal to the number of the option word choice.

It is through setting the IT array that FINDIT signals subroutine INPUT as to which keyword and optionwords were found on the input card. Of course, in the case of numeric data or OVERRIDE record names, the values in the B array will have further use even after IT has been determined.

9.22 GETRNG Subroutine.

This subroutine samples the cumulative distribution of acquisition ranges (actually designator-to-target ranges at time of unmask) to obtain the initial designator-to-target range for the current replication. The cumulative distribution of line-of-sight segment lengths corresponding to the range bracket in which the designator-to-target range lies is then sampled to obtain the length of the segment of the target's path that is visible to the DO. This LOS segment length is then added to the target column's length and the sum is divided by the target velocity to obtain the duration of line of sight (i.e., the length of the time interval from target unmask until LOS to last vehicle in column is lost). Next a return is executed.

If the target velocity is zero (or negative) an error stop with message occurs.

9.23 GETTIM Subroutine.

This subroutine serves three basic functions: (1) perform test 8, (2) perform test 9, and (3) calculate the response time (time from DO call for fire until gun is ready to fire Copperhead) for those missions that pass tests 8 and 9.

As mentioned in Chapter 2, there are three different ways of playing communication and processing delay times.

- (1) If parameterized response time (PRSPTM) is non-zero, then this routine sets the time the gun is ready to fire (TIMNOW) equal to PRSPTM. It then performs test 8 and 9. If either test fails, ABRTTL is called and a return occurs; otherwise, ABRTTL is not called and the routine executes a return with TIMNOW = PRSPTM.
- (2) If parameterized response time is zero, then the routine is to sample to obtain response time. If the variable FTSILL is TRUE, the routine samples the single response time distribution (FSRT array) to obtain the response time which is then added to the detection time to obtain the time at which the gun is ready to fire. It then performs tests 8 and 9. If either test fails, ABRTTL is called and a return occurs; otherwise, ABRTTL is not called and the routine executes a return with TIMNOW set at the value to be used for this replication.

(3) Finally, if parameterized response time is zero and the variable FTSILL is FALSE, then the routine uses the sum of the separate response time components as the response time. If digital communication is modeled, then the time to enter digital data into DMD is sampled and added to current time (TIMNOW which was previously set to DETTIM).

Then an unnumbered test is made to determine whether digital commo is successful. If it is, a transmission time is added to TIMNOW and control transfers to statement 160 (see below). If digital commo fails, then a test is performed to determine whether voice commo is successful. If voice is successful, then a time to switch from digital to voice and the voice commo transmission time are added to TIMNOW before control transfers to statement 160. If voice is also unsuccessful, then test 8 is considered to have been failed, ABRTTL is called, and a return executed.

If digital commo is not selected, then voice commo only is played. In this case, the test for successful voice commo is made (test 8) and if failed, an abort (call to ABRTTL) occurs followed by a return. If the test is passed, a voice commo time is added to TIMNOW and control reaches statement 160.

At statement 160, the battery computer system processing and battery response time are added to TIMNOW. Test 9 is then performed. If it fails, ABRTTL is called and a return executed; if it is passed, then TIMNOW is returned to be used for the current replication.

9.24 GETVIS Subroutine.

This subroutine samples the weather data used in the current case to obtain the cloud ceiling altitude and the visibility range limit.

The routine first randomly determines whether there is a cloud ceiling. Next it randomly determines whether there is a cloud free line-of-sight for the COPPERHEAD trajectory.

If there is a cloud-free line-of-sight, then the cloud ceiling altitude is set to its highest value and a visibility limit is determined by random sampling using the PRGCFL array. Control then branches to statement 160 (see below).

If there is no cloud-free line-of-sight, then the cloud ceiling altitude and visibility limit are both determined by a random sampling from the W array.

Note that the items of importance that are defined by this routine are the subscript of the cloud ceiling altitude (ICC), the subscript of the visibility range limit (IVL), and the visibility range limit itself (VISLIM). Also, note that ICC is initially a function of increasing altitude (that is, higher altitudes correspond to larger values of ICC); however, because the ordering convention for cloud ceilings was reversed between the weather data and the PE data, ICC is redefined after statement

160 by setting the new value of ICC equal to seven minus the old ICC value (so that higher altitudes correspond to lower values of ICC).

9.25 HEADER Subroutine.

This subroutine produces the heading page for each case.

The heading page is produced by encoding the lines for the first column of boxes into the AOUT array; those for the second column into the BOUT array; and those for the third column into the COUT array.

Next the routine generates some comments regarding time inconsistencies, record name overrides, and data read by the TEMPORARY option as applicable.

Finally, following the lines giving case number and number of replications (which are written before HEADER does any encoding) HEADER writes the AOUT, BOUT, and COUT arrays to produce the nine boxes of case description information that occur on the case header page. Then if any "\$\$" comments are to be printed for this case, the CMENT array is written (this includes both user comments and program generated comments).

9.26 HITCHK Subroutine.

This subroutine performs test 18.

First, it interpolates with respect to designator-to-target range (RNGNOW) in the proper row of the TTF array as determined by designator type and target posture (exposure) to obtain the probability of hit. This probability of hit is really the probability of hit given that the round engages (that is, that the seeker locks onto the laser spot on the target and does so within the maneuver footprint of the COPPERHEAD round).

Next the routine compares a random number (between 0 and 1) to the probability of hit to determine whether the current round hits. If the round hits, a return occurs; if not, ABRTTL is called to record the failure (miss) and a return occurs.

9.27 INITLZ Subroutine.

The subroutine initializes certain case independent values.

After setting IRAY and calling SYSTEMC to set the non-standard error recovery process, the routine proceeds to set the values of CHAR (2,I) for $I=1,2,\ldots$ NREC from the values in the record named OPTNNUMS on Tape 11. (This record is automatically updated by the PREPMS program each time new optionword character strings are added for a keyword).

The program next calls DFAULT to set the default values for the various case descriptors, record names, etc. Then USET is called to set the values to be used as the base to which the first case input card values are to be applied. Finally, MSABLM is set and a return is executed.

9.28 INPUT Subroutine.

This subroutine reads the input lines for a given case and sets the variables in the program to the values required to run the case.

This routine is the longest and one of the most complex in the COPE model. It is most easily followed by means of a flowchart (see Chapter 11); however, an attempt to sketch its main sections is given here.

- (1) First, the routine checks to determine whether there is another case to read. If not, it stops. If there is more to read, the routine first sets IRAY and calls SYSTEMC to establish non-standard error recovery. Then it clears various arrays and counters and increments the case number.
- (2) Next it reads input cards until it encounters an END, ENDF, or end-of-file. For each card that it reads, it first checks whether that card is a comment card; if it is, subroutine COMMNT is called and the next card is read. If the card is not a comment, the routine calls SEPREC which separates the fields on the input card and moves each of them into a line of the B array. Then subroutine FINDIT is called to match each line in the B array against the keywords and option words allowed in that field. This matching determines the values of the IT array.

The program next checks to see whether the current card supersedes some of the previous cards for the current case. If it does, a comment is generated; in either case, the routine next branches to one of five statements depending on whether the card is a FIRST CASE, NEXT CASE, END, ENDF, or any other card, respectively. If the card is an END or ENDF, control transfers to statement 490 (see below). If the card is a NEXT CASE, RD (or equivalent), USET is called to establish the default values as the base to which changes caused by the input cards are to be applied; if the card is NEXT CASE, DR, then USET is not called and the changes caused by the input cards are applied to the conditions in effect for the previous case. Either type of NEXT CASE (or FIRST CASE) causes control to then read the next card. If the card is not an END, ENDF, NEXTCASE, or FIRST CASE, then control reaches statement 200.

At statement 200, a many branched computed GO TO is executed; the branch followed depends on the keyword number (IT1 or IT(1)). The actions taken for each case of the computed GO TO are varied but the main activities are to fill the UVALUE array with either numerical values, record names, or flag values. If the keyword was TEMPORARY, CREAD is called; if OVERRIDE, the record name is set; and if RESET, the default for that keyword is reactivated. Each case of the computed GO TO ends with a GO TO returning control to the line that reads the next input card.

- (3) At line 490 the routine starts filling in the values of the various parameters that describe the current case (flags, arrays, single variables, etc.). These are generally filled in by calls to READMS to read records to fill in data blocks (record names as established when filling in UVALUE array), by equating variables to UVALUE numerical values, by looking up values in pre-defined arrays according to a subscript value in UVALUE array, by calling a special subroutine (in the case of PEDATA) to generate a record name and then reading that record from TAPE 11 into the data block, or by calling special routines (such as PSMOKE) that use inputs to calculate a parameter value. In any event, by the end of INPUT all variables required to run the case have been set and the replications can begin.
 - (4) INPUT finishes by calling HEADER and ECHO and then returning.

9.29 LOSCHK Subroutine.

This subroutine is used to determine whether the DO still has (macro-terrain) LOS to the target when the round arrives (test 12).

 $\hbox{ It performs the test in two different ways depending on the LOS model used.} \\$

For "shooting gallery", it merely compares the time the round arrives with the duration of the line-of-sight. If the round arrives before the line-of-sight ends, a return is executed; if the LOS ends before the round arrives, ABRITL is called prior to the return.

For the "random occurrence" LOS model, the probability P of LOS to a single vehicle in the current designator-to-target range bracket is found. The probability that at least one vehicle is in view is then taken to be equal to 1-(1-P)**XNV where XNV is the number of target vehicles currently unkilled. Once this probability is obtained, it is compared to a random number and the result settles test 12. If test 12 is passed, a return occurs; if it is false, ABRTTL is called, then a return occurs.

9.30 MINTRN Subroutine.

This subroutine performs test 16 and sets target posture (exposure) with respect to mini-terrain.

First the current designator-to-target range is computed. Then this range is used to interpolate in each of the three rows of the PSTTBL array. As a result of this interpolation the PSTVAL array is filled with the probabilities of completely obscured target posture, fully exposed target posture, and hull defilade (turret exposed) target posture respectively.

A random number is then drawn and compared to these probabilities to determine which of the three target postures occurs. If the target posture is "completely obscured", then test 16 is failed, ABRTTL is called, and a return occurs; otherwise, ITGTPS is set to indicate the target posture (1 for fully exposed; 2 for hull defilade) to be used in hit and kill probability tests and a return occurs.

9.31 NOREC Subroutine.

This routine is called indirectly through the CDC non-standard error recovery facility (SYSTEMC routine explained in CDC Fortran 4 Extended) It is called whenever READMS attempts to read a record from TAPE 11 using a record name that does not correspond to any of the records on TAPE 11.

The routine writes a message giving the record name that could not be found, executes a subroutine call trace and then executes a stop with message.

9.32 OUTPUT Subroutine.

This subroutine writes the results page for each case.

The routine begins by clearing several arrays.

Next, it calculates the percentage of total missions that have a failure (abort) at each test (for "round" aborts, this percentage is calculated for each round). This is the ABRPCT array.

Then it calculates what percentage of the missions that reached a given test passed it. Again this is calculated for each round for the "round" aborts. This is the PASPCT array.

Next the program sets the number of occasions, attempted engagements, and shots.

Then it compares the number of kills as calculated by two different counters and, if there is a disagreement in value between them, it prints a message (see Section 7.3.1).

Next, it calculates the probability of kill given an occasion, the probability of kill given an attempted engagement, and the probability of kill given a shot. These are calculated separately for each round of the mission.

Then it calculates the probability of a shot given an occasion, probability of a shot given an attempted engagement, and probability of attempted engagement given a shot. It also calculates the probability of having line-of-sight on each round.

Next it compares the number of missions (or rounds, as appropriate) tested for each abort condition as computed in two different ways. If the results differ an error message is generated (see section 7.3.2).

Then the program calculates the FO (DO) survivability measures; that is, probability DO is killed and probability DO is not killed given that the mission reached that test.

Now that all of the values to be printed on the results page have been calculated the routine proceeds to print the results in the order they appear on the case results page (see Chapter 6).

Note that prior to printing percentages, function FPRCNT is applied to format the percentages for output. Also note that any percentage valued variables with the value -1.0 are printed as "UNDEF" indicating undefined value (this occurs when the percentage could not be calculated due to a zero denominator. It is for this reason that all percentage valued variables in OUTPUT are initialized at -1.0 and then only assigned values if the ratio used in computing the percentage has non-zero denominator).

9.33 PECHK Subroutine.

This subroutine performs test 17 (i.e., does COPPERHEAD round engage the target?)

First it calculates the delay time (DELTAT) for the current round. By delay time is meant the time the round arrives minus the expected arrival time (which is based on nominal response time). Next the value of IMUTS (the "MUTS" factor -- see Section 16.1) is determined and the range value indices to be used for interpolation are set.

If IMUTS is 2, it means that not all vehicles in the target column have passed the point of closest approach to the centroid of the COPPERHEAD footprint. That is, delay has no effect and so PE is computed by interpolating with respect to designator-target range alone in the PETBL array (using delay time equal to zero (IDELTT=1) and holding cloud ceiling and visibility limit constant at their previously sampled values (obtained in GETVIS)).

If IMUTS is 1, it means that all vehicles in the target column have passed the point of closest approach to the centroid of the COPPERHEAD footprint. That is, delay time has an effect and so PE is computed by interpolating with respect to both designator-target range and delay time while holding cloud ceiling and visibility limit constant.

In either case, once PE (probability that seeker engages target and target is within Copperhead maneuver footprint) is computed, it is compared to a random number sampled from a uniform distribution (from 0 to 1). If the random number is less than PE, a return occurs; otherwise, ABRITL is called before the return occurs.

9.34 PENAME Subroutine and PEIDNT Entry.

This subroutine takes ten arguments. When the call is to PENAME the first nine are "input" and the last one is "result"; whereas a call to PEIDNT uses the current value of the tenth argument as "input" and returns the values for the other nine.

This subroutine is used to create PE data record names. The values of the nine parameters (see section 5.4) are taken as arguments (in the same order they are described in section 5.4). They are loaded into the AVALUE array and are searched for in the XVALUE array. When matches are found, the corresponding XVALUE entries (for XVALUE (I,J,2)) are used to construct the record name which is returned as IDCODE.

When PEIDNT is called, the record name is decomposed into the separate XVALUE (I,J,2) values (and TR value) used to create it. The corresponding XVALUE (I,J,1) values are found and equated to the nine parameters (note slightly different handling of TR, nominal response time). These values are then returned.

Note that while every choice of the nine parameters can give at most one record name, there may be more than one choice of parameters that can give that record name. For example, if all parameters are held constant except target velocity (VEL), then VEL = 2 m/s and VEL = 3 m/s will give the same record name (using the current XVALUE array). Hence, when that record name is decoded by PEIDNT to obtain the parameters to which it corresponds, it will have no way of choosing between 2 m/s and 3 m/s for VEL; instead it will merely take the first one that matches (2 m/s in this case).

9.35 PKCHK Subroutine.

This subroutine performs test 19 (i.e., did the COPPERHEAD kill the target?)

The routine looks up the PK (probability of kill given a hit) in an array as a function of target type and target posture (exposure). This value is then compared to a random number sampled from

a uniform distribution (from 0 to 1). If the random number is less than PK, then a kill occurs, the number of vehicles killed on the KRFth round for this case (RNDREC) is incremented, the number of vehicles killed (NVEHKL) on this replication is incremented and a return occurs. If not, ABRTTL is called and then the return occurs.

9.36 PPLOT Subroutine.

This subroutine is currently just a "stub" that producess a "\$\$" program generated comment saying that no printer plot was produced for the current case.

If implemented, this routine would produce printer plots (bar graphs) giving a graphical presentation of case results.

9.37 PSMOKE Subroutine.

This routine calculates the probability that smoke aborts the potential COPPERHEAD mission. This probability is a function of the number of each of two types of smoke rounds fired (NSMK2 and NSMK5) and the distribution of Pasquill atmospheric stability categories, distribution of wind speed velocities, and distribution of relative humidity levels corresponding to the current case's weather (i.e., month and time of day).

The entire routine reduces to evaluating PSMKKL (probability smoke kills mission) according to the formula:

$$\begin{aligned} \text{PSMKLL} &= \frac{1}{\text{FRONT}} \sum_{I=1}^{3} \sum_{J=1}^{3} \sum_{K=1}^{2} \left\{ \text{MIN} \left(\frac{\text{NSMK2}}{\text{SMK2}(I,J,K)} + \frac{\text{NSMK5}}{\text{SMK5}(I,J,K)}, \text{FRONT} \right) * \\ & \text{WNDSPD}(I,J) * \text{HUMID}(K) * \left[\text{PASQL}(2*I-1) + \text{PASQL}(2*I) \right] \right\} \end{aligned}$$

where all of the variables are as defined in the Glossary of Variables (Chapter 12).

Note that because certain combinations of windspeed and Pasquill category never occur, the SMK2(I,J,K) and SMK5(I,J,K) values corresponding to them have been left blank (i.e., equated to zero). To avoid the division by zero that would otherwise result, the range of J in the summation is sometimes limited in the routine to avoid certain SMK2 and SMK5 values which should have no weight in the sum anyway.

9.38 REINTZ Subroutine.

This subroutine resets certain counter arrays to zero. It also resets the random number seeds for each case and on the first case it writes the seeds on Tape 8.

Note that the seeds are set according to the formula:

$$IR(I) = 2*(MOD(8**I, 29) *2**25/29) + 1$$

for $I = 1, 2, \dots, 28$.

This assures that each IR is odd and that the IR's are approximately uniformly spaced between 0 and 2^{26} .

9.39 RNDREL Subroutine.

This subroutine performs the test of round reliability (test 15).

9.40 RNGCHK Subroutine.

This subroutine performs test 3.

It compares designator-to-target range at unmask to the maximum designator range. If the maximum designator range is less than the designator-to-target range, ABRTTL is called and a return occurs; otherwise, the test is passed and a return occurs.

9.41 SEPREC Subroutine.

This subroutine takes a real array A of dimension N1 and breaks it up into fields (i.e., separates records) and compresses them one per line into the B array which is of dimension N2 by N3.

The routine first clears several arrays to be used in separating the fields on A. Then it calls IDCHAR once for each element of A to determine what kind of character it is. A is assumed to be an array (usually DIMENSION A(80)) of characters filled by reading one input card under 80A1 format.

If the routine encounters sequence numbers in columns 73-78 of the first card (i.e., elements 73-78 of array A) and blanks in 63-72 and 79-80, then it issues a "\$\$\$" comment (see section 7.1) and removes the sequence numbers on the first card and all subsequent cards (A arrays) of the current run. If it encounters something other than the blanks and sequence numbers as described above in columns 63-80 of the first card, then it leaves columns 73-78 unchanged on all cards of the current run.

Next the program separates the fields on the card (i.e., in A) and compresses them into B. It does this by copying one character at a time from A to PB omitting blanks (except when part of a ten

character string preceded by a "\$" sign) and starting a new line of PB every time a separator (comma, left or right parenthesis, question mark, or slash) is encountered. It then encodes each line of PB into a line of B so that each element of B contains up to ten characters.

This means that B(I,J) for $I=1,2,\ldots,8$ contains the characters of the Jth field of the input card compressed by removing blanks (with the exception noted) and packed ten characters per word (until the characters run out).

A return now occurs with the B array filled with the character strings to be compared to the keywords and option words allowed.

Note that an input card cannot have more than ten fields nor fewer than one. A field on an input card (or in A) is defined as a string of characters lying between two successive separators where for this definition we include the beginning of the card and the end of the card as separators and do not count characters that would otherwise be separators if they lie in a ten character string following a dollar sign. (The normal separators are mentioned above in this section).

9.42 SMOKE Subroutine.

It compares the value of PSMKKL calculated in PSMOKE with a random number sampled from a uniform distribution to determine whether smoke was sufficient to abort the potential Copperhead mission. As usual, if an abort occurs, ABRTTL is called prior to returning; otherwise, an immediate return occurs.

9.43 SMPLCD Subroutine.

This subroutine randomly samples from a cummulative distribution. As arguments, it takes an array A, its dimensions ND1, ND2, the row number NRS containing the values to be sampled, the number of entries NDR used in the row (NDR \leq ND1), and the random number seed IRNDM. It returns the value sampled XSMPL and the class ICLASS in which it falls.

This routine requires an array A with A(I,1) for I = 1,2,., NDR \leq ND1 consisting of probabilities A(1,1) = 0.0 \leq A(2,1) \leq ... A(NDR,1) = 1.0. The routine samples a random number RN from a uniform distribution (from 0 to 1) and then brackets this number with two entries from A(I,1) such that A(I,1) \leq RN \leq A(I+1,1).

The corresponding entries A(I,NRS) and A(I+1,NRS) from the NRSth row of A are obtained. The value sampled XSMPL is then defined by straight line interpolation, (i.e., XSMPL is defined so that the point (RN, XSMPL) lies on the line segment joining (A(I,1), A(I,NRS)) to (A(I+1,1), A(I+1,NRS))).

Put in terms of a formula, that means:

XSMPL = A(I,NRS) + (RN-A(I,1))*(A(I+1,NRS)-A(I,NRS))/(A(I+1,1) -A(I,1)).

ICLASS is then defined to be equal to I and a return occurs.

Note that A defines a cummulative distribution. That is, when sampling.

$$Pr(XSMPL \leq A(I,NRS)) = A(I,1)$$
 for $I = 1,2,...,NDR$.

Hence, the user must take care to use only cummulative distributions for the input data that will eventually be sampled.

9.44 TIMCHK Subroutine.

This subroutine performs test 11 (i.e., does the DO still have line-of-sight to the target when the battery is ready to fire?)

It is called only for the "shooting gallery" LOS model.

9.45 TITLE Subroutine.

This routine merely writes the Title page of the output (see Chapter 6). It also sets the date and time that the current run began.

9.46 USET Subroutine.

This subroutine is called when the next case to be run is to use the baseline (default) values of the case parameters as the base to which its own input cards are to be applied.

The routine sets the UVALUE common block and a few other variables to their default values. Whatever inputs the next case then contains are applied to changing these variables from their defaults rather than from the previous cases values.

9.47 VISCHK Subroutine.

This subroutine performs test 2.

It compares designator-to-target range at unmask to the visibility range limit. If the visibility range limit is less than the designator-to-target range, ABRTTL is called and a return occurs; otherwise, the test is passed and a return occurs.

9.48 WARNDO Subroutine.

This subroutine performs test 13.

If the current round is the first of this COPPERHEAD mission, then a random number is sampled from a uniform distribution and compared to the probability that DO is warned to lase to determine whether the DO received the message to begin lasing. If he did receive the message, the test is passed and a return occurs; if not, ABRTTL is called prior to returning.

If the current round is \underline{not} the first round of this COPPERHEAD fire mission, then DO is assumed to have been warned either by communication or by sighting the impact of the first round and, in either case, turns on his laser so test 13 is passed and a return occurs.

CHAPTER 10

10. MEMORY ORGANIZATION: COMMON BLOCKS AND EQUIVALENCE CLASSES

10.1 Common Blocks.

This chapter describes the common blocks and equivalence classes in COPE. This organization of the values stored in memory is a matter of some importance to anyone attempting to modify the program.

Tables 10-1 and 10-2 give, respectively, a list of the common blocks in each subprogram of COPE and a list of the subroutines in which each common block occurs.

10.2 Equivalence Classes.

Table 10-3 gives the equivalence classes. There are twelve equivalence classes used in COPE (some are used in more than one subroutine). The equivalence classes are described below in alphabetical order of the names of their first items. Eight of the twelve equivalence classes are the eight data blocks referred in Section 4.5.1.:

ACQDAT is the Acquisition Range data block, AINVDA is the Invariant data block, DFSDAT is the Direct Fire Suppression data block, PEDATA is the Probability of Engagement data block, STDAT is the Target Posture Distribution data block, RODATA is the Random Occurrence data block, RSPDAT is the Response Time data block, and WDATA is the Weather data block.

These data block equivalence classes (along with a MAX equivalence class which has nothing to do with COPE's use of PREPMS) are also present in the PREPMS program.

Each equivalence class is formed by an equivalence statement establishing that one array or non-subscripted variable occupies the same memory locations as a set of one or more other arrays or non-subscripted variables. In each case the one array or non-subscripted variable (after which the equivalence class is named in Table 10-3) occupies all of the computer memory used by that equivalence class and so is dimensioned with a value equal to the entire length of the equivalence class (if the length is 1, then the equivalence class occupies but one word of computer memory and the class is named after a non-subscripted variable).

In Table 10-3, the information about each equivalence class is separated by dashed lines and is read as follows:

The first entry on the left gives the name of the equivalence class.

The next entry (length) gives the length of the equivalence class in terms of the words of computer memory occupied by the members of the equivalence class. This length is also the dimension of the array (or non-subscripted variable if length is one) in the first entry.

The entries under "MEMBERS" give bias, name, and length of each member. That is, for each member (variable) of the equivalence class (other than the member in the first entry above) there are three items given: first the bias or number of words preceding the variable in that equivalence class in computer memory space, second the variable (or array) name, and third the length of the array (or non-subscripted variable) in terms of computer words (one for non-subscripted variables).

Note that for each equivalence class, the memory space occupied is part (or all) of some common block. This correspondence is as follows:

ACQDAT is in the RNGLOS common block, AINVDA is in the HIT common block, D is in the DVALUE common block, DFSDAT is in the DODF common block, ICODE is in the ICODE common block, PEDATA is in the HIT common block, PSTDAT is in the HIT common block, RECODE is in the RECNAM common block, RODATA is in the RANDOC common block, RSPDAT is in the RSPTIM common block, U is in the UVALUE common block, and WDATA is in the WEATHR common block.

Also, note that the variables in an equivalence class may be used (under their names in the COMMON statements) in subprograms other than those in which the equivalence class is defined.

TABLE 10-1 COMMON BLOCKS IN EACH SUBPROGRAM OF THE COPE PROGRAM

SUBPROGRAM	COMMON	BLOCKS					
ABRTTL	ABORT	FLAG	RPLOTN				
ADDTBR	TIME						
ADDTOF	TIME						
ARTCHK	KTEST	MISC	RANDOM	RPLCTN			
BDATA1	ABRLBL LOGFLG	ACHAR POINT	DESRNG SMOKED	DISPLY STITLE	FLTTIM SYMBOL	FSRESP XVALUE	HEADNG
BLOCHK	BAIL	KTEST	RANGE	RPLCTN	TARGET	TIME	
CCPLOT	RUNDAT						
COMMNT	COMENT						
COPE	ABRLBL FLTTIM SMOKED	ACHAR FSRESP STITLE	BAIL HEADNG SYMBOL	DESRNG LOGFLG TIME	DISPLY POINT XVALUE	DODF RPLCTN	FLAG RUNDAT
CREAD	DODE	HIT	RANDOC	RNGLOS	RSPTIM	WEATHR	
DETCTN	FLAG	KTEST	RANDOM	RPLCTN	RSPTIM	TIME	
DFAULT	DVALUE	RUNDAT					
DECHK	DODF WEATHR	KTEST	RANDOM	RANGE	RPLCTN	TARGET	TIME
DUST	KTEST	MISC	RANDOM	RPLCTN			
ECHO	BAIL PEDESC RUNDAT	DODF RANDOC SMOKED	FLAG RANGE TARGET	HIT RECNAM TIME	LOGFLG RNGLOS WEATHR	MISC RPLCTN	OVER RSPTIM
FINDIT	ACHAR	ICODE	INDEX1	TADMUR	SYMBOL		
GETRNG	RANDOM	RANGE	RNGLOS	RPLCTN	TARGET	TIME	WEATHR
GETTIM	FLAG TIME	FSRESP	KTEST	LOGFLG	RANDOM	RPLCTN	RSPTIM
GETVIS	RANDOM	RANGE	RPLCTN	WEATHR			
неарек	BAIL OVER SMOKED	COMENT PEDESC SYMBOL	DISPLY RANGE TARGET	FLAG RECNAM TIME	HEADNG RPLCTN UVALUE	LOGFLG RSPTIM	MISC RUNDAT
нітснк	HIT TIME	KTEST	МОЦИАЯ	RANGE	RPLCTN	RSPTIM	TARGET
IDCHAR	SYMBOL						

TABLE 10-1 COMMON BLOCKS IN EACH SUBPROGRAM OF THE COPE PROGRAM - CONTINUED

SUBPROGRAM	COMMON	BLOCKS					
INITLZ	ABORT UVALUE	ACHAR	DVALUE	FLAG	ICODE	INDEXI	RUNDAT
INPUT	ABORT FLAG OVER RNGLOS TIME	BAIL FLTTIM PEDESC RPLCTN UVALUE	COMENT HIT POINT RSPTIM WEATHR	DESRNG ICODE RANDOC RUNDAT	DISPLY INDEX1 RANDOM SMOKED	DODF LOGFLG RANGE SYMBOL	DVALUE MISC RECNAM TARGET
гозснк	FLAG TIME	KTEST	RANDOC	RANDOM	RANGE	RPLCTN	TARGET
MINTEN	HIT	KTEST	RANDOM	RANGE	RPLCTN	TARGET	TIME
NOREC	ICODE						
NUMRIC	SYMBOL						
TUSTUO	ABORT SCCSS	ABRLBL	DODE	FLAG	KTEST	RPLCTN	RUNDAT
PECHK	FLAG TARGET	HIT TIME	KTEST WEATHR	RANDOM	RANGE	RPLCTN	RSPTIM
PENAME	XVALUE						
ькснк	ніт	KTEST	RANDOM	RPLOTN	scoss	TARGET	
PPLOT	RUNDAT						
PSMOKE	SMOKED	WEATHR					
REINTZ	ABORT	KTEST	RANDOM	RPLOTN	scess		
RNDREL	KTEST	MISC	RANDOM	RPLCTN			
RNGCHK	KTEST	RANGE	RPLCTN				
SEPREC	COMENT	LOGELO	SYMBOL				
SMOKE	KTEST	RANDOM	RPLCTN	SMOKED	WEATHR		
TIMCHK	FLAG	KTEST	RPLCTN	TIME			
TITLE	RUNDAT	STITLE					
USET	DVALUE	LOGFLG	OVER	UVALUE			
ATSCHK	KTEST	RANGE	RPLOTN				
WARNDO	FLAG	KTEST	RANDOM	RPLCTN	RSPTIM	TIME.	

TABLE 10-2 SUBPROGRAMS OF COPE IN WHICH EACH COMMON BLOCK OCCURS

	A1188555	DAMO.		· · · · · · · · · · · · · · · · · · ·			
COMMON	SUBPROG	RAMS					
ABORT	ABRTTL	INITLZ	INPUT	OUTPUT	REINTZ		
ABRLBL	EDATA1	OUTPUT					
ACHAR	BDATA1	FINDIT	INTTLZ				
BAIL	BLOCHK	COPE	ECHO	HEADER	INPUT		
COMENT	COMMNT	HEADER	INPUT	SEPREC			
DESRNG	BDATA1	INPUT					
DISPLY	BDATA1	HEADER	INPUT				
DODE	COPE	CREAD	DECHK	ЕСНО	INPUT	OUTPUT	
DVALUE	DFAULT	INITLZ	INPUT	USET			
FLAG	ABRTTL INPUT	COPE LOSCHK	DETCTN OUTPUT	ECHO PECHK	GETTIM TIMCHK	HEADER WARNDO	INITLZ
FLTTIM	BDATA1	INPUT					
FSRESP	BDATAI	GETTIM					
HEADNG	BDATA1	HEADER					
HIT	CREAD	ECHO	нітснк	INPUT	MINTRN	PECHK	PKCHK
ICODE	FINDIT	INITLZ	INPUT	NOREC			
INDEX1	FINDIT	INITLZ	INPUT				
KTEST	ARTCHK LOSCHK RNGCHK	BLOCHK MINTRN SMOKE	DETOTN OUTPUT TIMOHK	DECHK PECHK VISCHK	DUST PKCHK WARNDO	GETTIM REINTZ	HITCHK RNDREL
LOGFLG	BDATA1	ECHO	GETTIM	HEADER	INPUT	SEPREC	USET
MISC	ARTCHK	DUST	ECHO	HEADER	INPUT	RNDREL	
OVER	ECHO	HEADER	INPUT	USET			
PEDESC	ЕСНО	HEADER	INPUT				
POINT	BDATA1	INPUT					
RANDOC	CREAD	ECHO	INPUT	LOSCHK			
RANDOK	ARTCHK HITCHK RNDREL	DETCTN INPUT SMOKE	DFCHK LOSCHK WARNDO	DUST MINTRN	GETRNG PECHK	GETTIM PKCHK	GETVIS REINTZ
RANGE	BLOCHK INPUT	DFCHK LOSCHK	ECHO MINTRN	GETRNG PECHK	GETVIS RNGCHK	HEADER VISCHK	нітснк

TABLE 10-2 SUBPROGRAMS OF COPE IN WHICH EACH COMMON BLOCK OCCURS - CONT'D

COMMON	SUBPROC	RAMS					
RECNAM	ECHO	HEADER	INPUT				
RNGLOS	CREAD	ECHO	GETRNG	INFUT			
RPLCTN	ABRTTL ECHO LOSCHK RNGCHK	ARTCHK GETRNG MINTRN SMOKE	BLOCHK GETTIM OUTPUT TIMCHK	COPE GETVIS PECHK VISCHK	DETCTN HEADER PKCHK WARNDO	DFCHK HITCHK REINTZ	DUST INPUT RNDREL
RSPTIM	CREAD PECHK	DETCIN WARNDO	ECHO	GETTIM	HEADER	нітенк	INPUT
RUNDAT	CCPLOT INPUT	COPE OUTPUT	DFAULT PPLOT	ECHO TITLE	FINDIT	HEADER	INITLZ
80088	OUTPUT	PKCHK	REINTZ				
SMOKED	BDATA1	ECHO	HEADER	INPUT	PSMOKE	SMOKE	
STITLE	BDATA1	TITLE					
SYMBOL	BBATA1	FINDIT	HEADER	IDCHAR	INPUT	NUMBIC	SEPREC
TARGET	BLOCHK LOSCHK	DFCHK MINTRN	ECHO PECHK	GETRNG PKCHK	HEADER	нітснк	INPUT
TIME	ADDTBR GETRNG PECHK	ADDTOF GETTIM TIMCHK	BLOCHK HEADER WARNDO	HITCHK COPE	DETCTN INPUT	DFCHK LOSCHK	ECHO MINTRN
UVALUE	HEADER	INITLZ	INPUT	USET			
WEATHR	CREAD PSMOKE	DFCHK SMOKE	ECHO	GETRNG	GETVIS	INPUT	PECHK
XVALUE	BDATA1	PENAME					

TARIF 1	0 - 3	COPF	EQUIVALENCE	CLASSES
INDLL I		001 -	LQUIIIIL	· - · · ·

NAME (Name of First Item)	LENGTH		EMBERS Name -	Length
ACQDAT	161		NRP NPP NRNGCL CRNGD SEGLOC RNGCLB VELTBL	22 121
(Occurs in subroutines CREAD	and INPUI)			
AINVDA (Occurs in subroutines CREAD	167 and INPUT)	0 6 26 27 47	DLTT PKTBL NRNGTT RNGTTF TTF	20
D (Occurs in subroutine INPUT)	70	0	DVALUE	70
DFSDAT (Occurs in subroutine CREAD	31 and INPUT)	0 30	DFDOKL NDFSP	
ICODE (Occurs in subroutines FINDI	l T, INITLZ, and	O INPUT)	CODE	1
PEDATA (Occurs in subroutines CREAD	4260 and INPUT)	0 60		

TABLE 10-3 COPE EQUIVALENCE CLASSES - CONT'D

NAME (Name of First Item)	LENGTH	Bias	MEMBERS Name	Length
PSTDAT	41	0 1 11	NRNGPS RNGPST PSTTBL	1 10 30
(Occurs in subroutines C	READ and INPUT) 			
RECODE	8	0 1 2 3 4 5 6 7	WCODE ACCODE RSCODE DFCODE ROCODE PECODE PSCODE AICODE]]]]]]]
(Occurs in subroutine (HI				
RODATA	22	0 1 2 12	TCRIT NPLOSR RNGPLS PRBLOS	1 1 10 10
(Occurs in subroutines CF	READ and INPUT)			*
RSPDAT (Occurs in subroutines CR	49 READ and INPUT)	0 3 5 6 10 14 18 22 42 43	BATRTM XMVADF DUM1 BCSPTM XMTTIM TMEAN TSIGMA DETTMA NDT TRARRY	3 2 1 4 4 4 4 20 1 6

TABLE 10-3 COPE EQUIVALENCE CLASSES - CONT'D

NAME (Name of First It	tem) LENGTH	Bias	MEMBERS Name	Length
U (Occurs in subro	70 utines HEADER and INPUT)	0	UVALUE	70
WDATA	193	0 1 3 25 157 168 174 175 176 182	PRCLCG PRCFLS PRGCFL W VIS CLOUD NCC NVL PASQL WNDSPD HUMID	1 2 22 132 11 6 1 6 9
(Occurs in subro	utines CREAD and INPUT)			

CHAPTER 11

11. FLOWCHARTS

This chapter includes flowcharts of the COPE main program and subroutine INPUT. Flowcharts of the other subroutines are not included since they are generally simple enough to understand by reading the descriptions in chapter 9 and studying the actual program code with the aid of the glossary of variables in chapter 12.

Several conventions are observed in the flowcharts. First, connectors on-page are indicated by circles whereas connectors off-page are indicated by pentagons. Numbered connectors correspond to actual statement numbers in the program code whereas letter connectors are merely flowcharting conveniences. Each STOP block in the flowchart includes the section number of this report that explains that stop.

A list of abbreviations used in the flow charts is included on the next page.

ABBREVIATIONS USED IN FLOW CHARTS

acq	Acquisition	OW	Option word
CLGP	COPPERHEAD	param	parameterized
C.O.	Completely obscured	pr	priority
comt	comment	prob	probability
desig	designator	rd(s)	round(s)
DF	direct fire	resp	response
dgt	digital	R.N.	random number(s)
D.O.	designator operator	rng	range
F.E.	fully exposed	SG	shooting gallery
fn	function	smk	smoke
H.D.	hull defilade	supp	suppression
hdng	heading	temp	temporary
KW	keyword	tgt	target
max	maximum	vel	velocity
mo	month	vis	visibility
ms g	message	w/	with
msn	mission	#	number
no	number		

night

option

nt

opt

Flowchart of Main Program of COPE

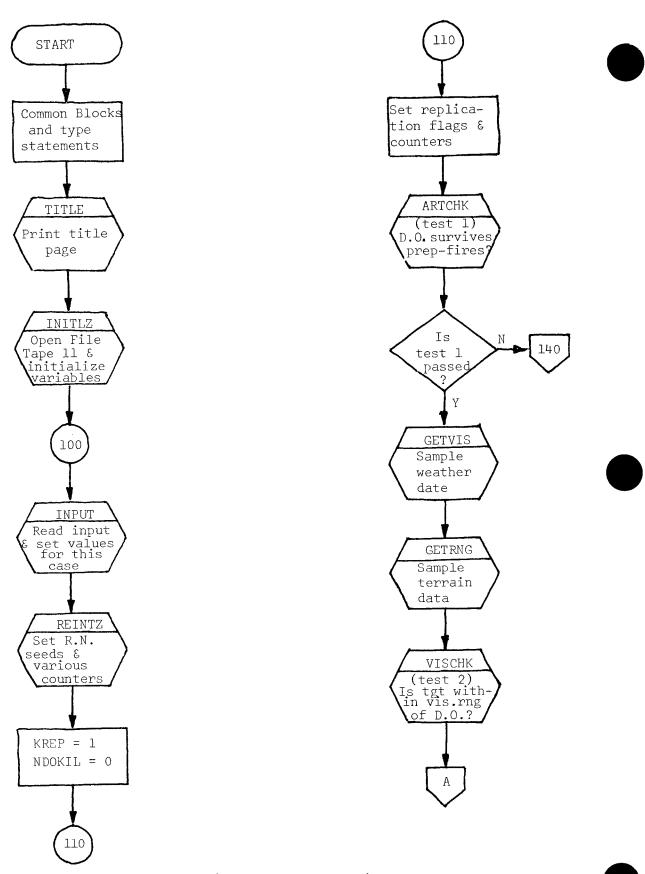
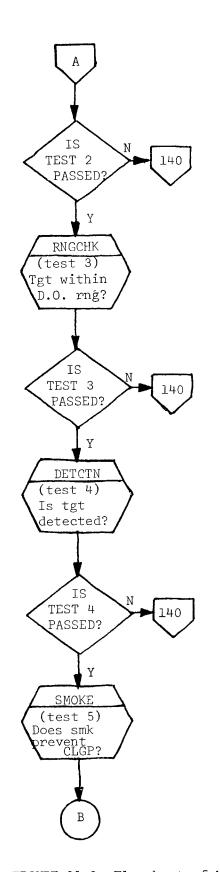


FIGURE 11-1 Flowchart of Main Program of COPE (Page 1 of 5)



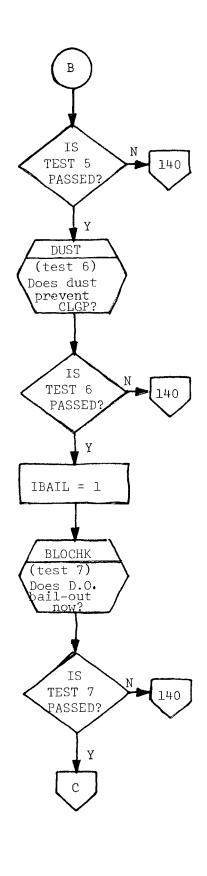


FIGURE 11-1 Flowchart of Main Program of COPE (Page 2 of 5)

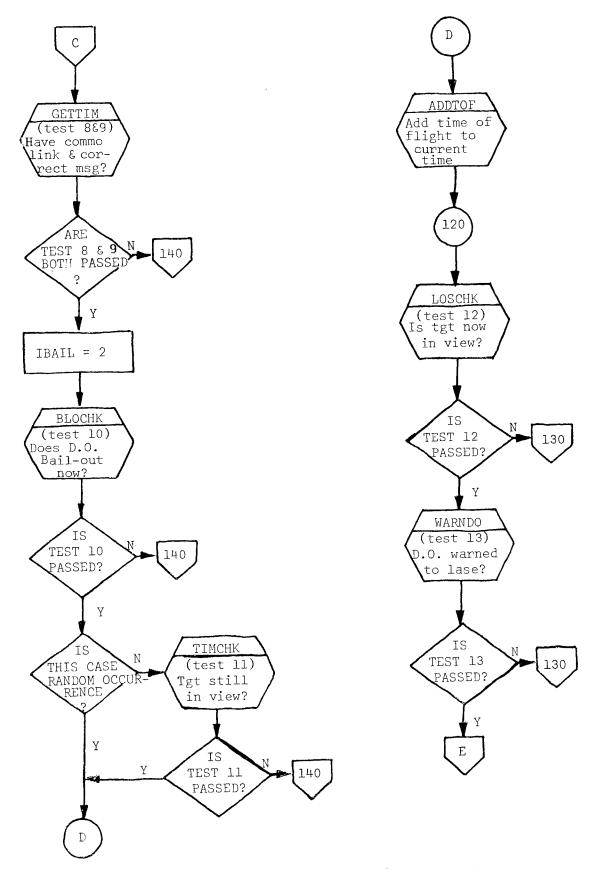
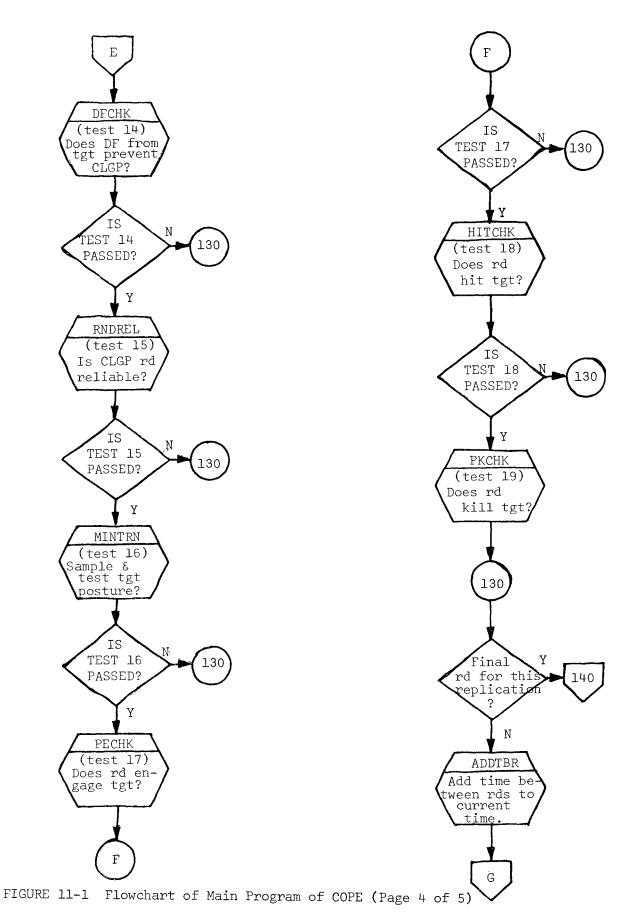
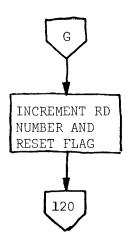


FIGURE 11-1 Flowchart of Main Program of COPE (Page 3 of 5)



11-7



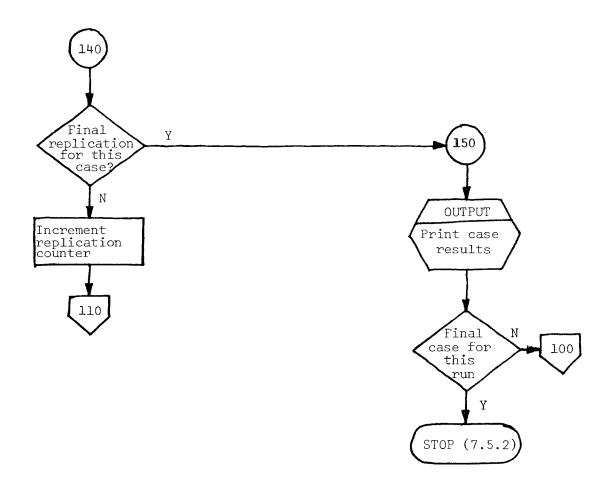
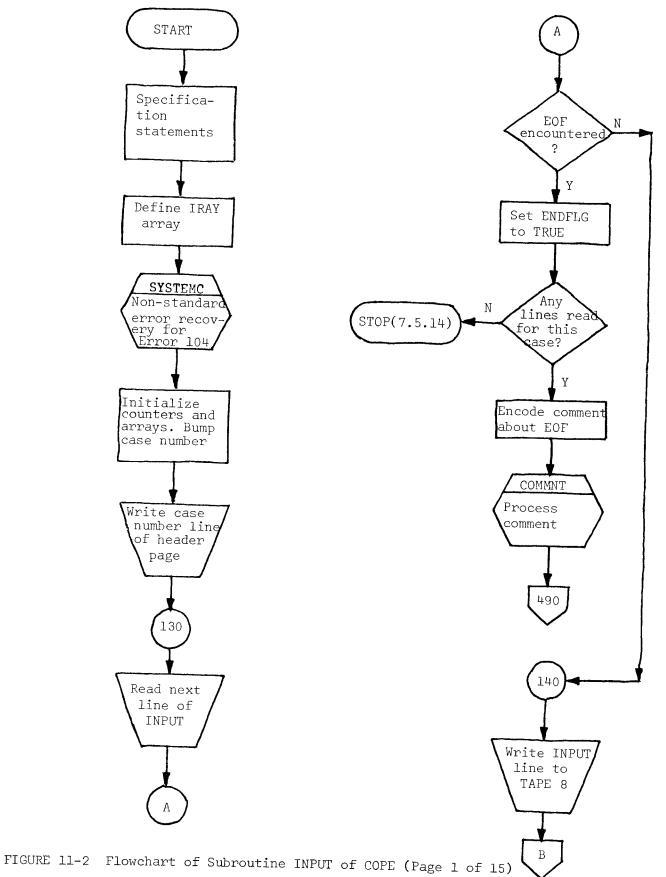


FIGURE 11-1 Flowchart of Main Program of COPE (Page 5 of 5)

Flowchart of Subroutine INPUT of COPE



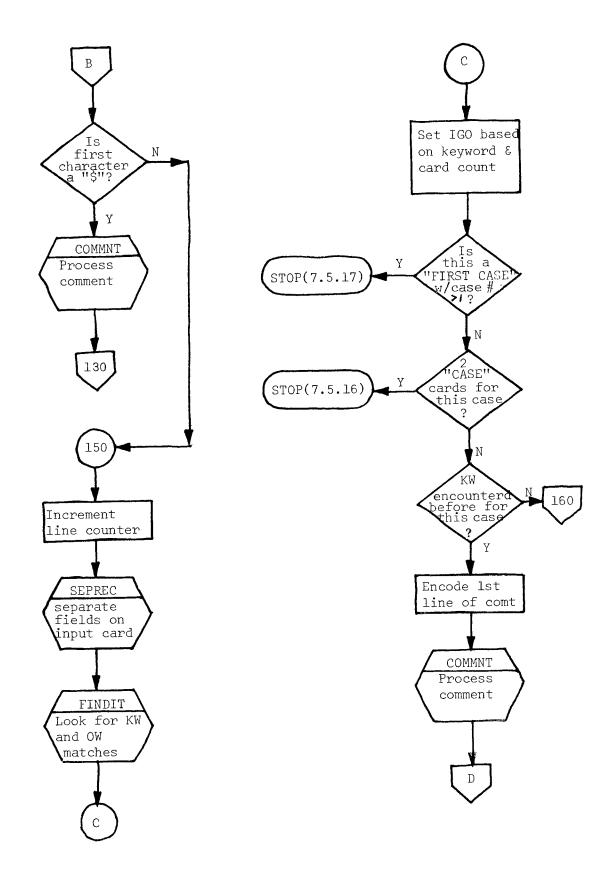


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 2 of 15)

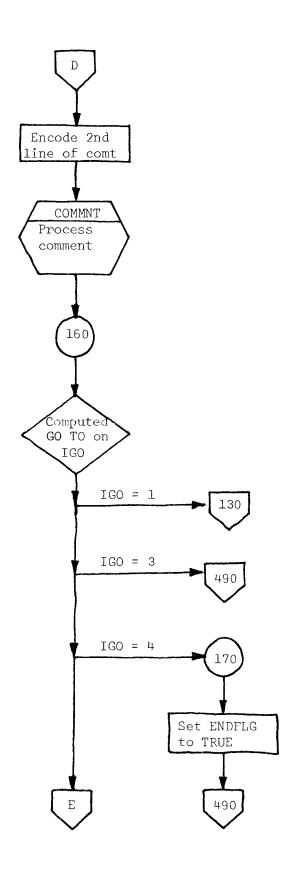


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 3 of 15)

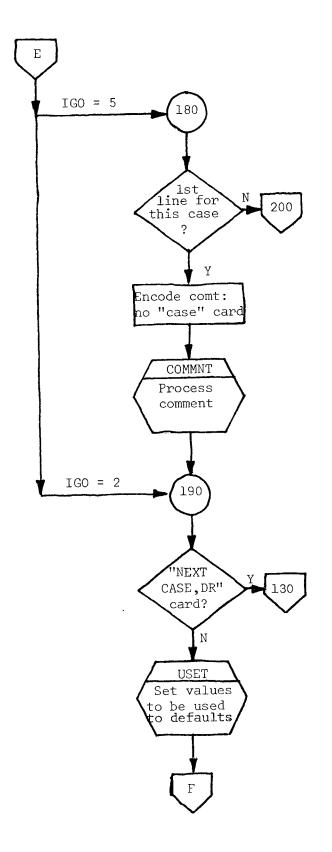


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 4 of 15)

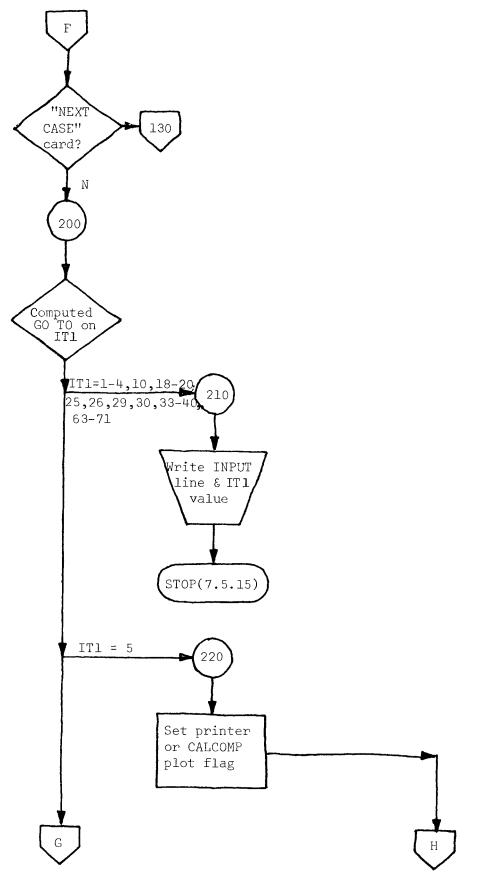


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 5 of 15)

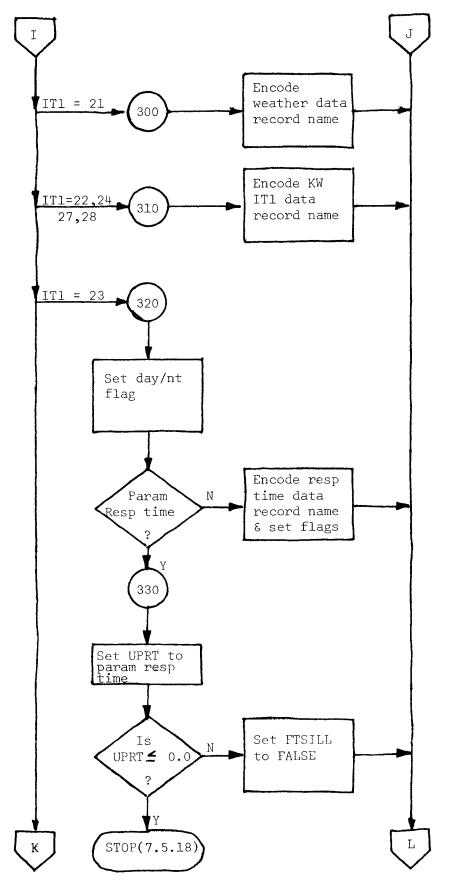


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 7 of 15)

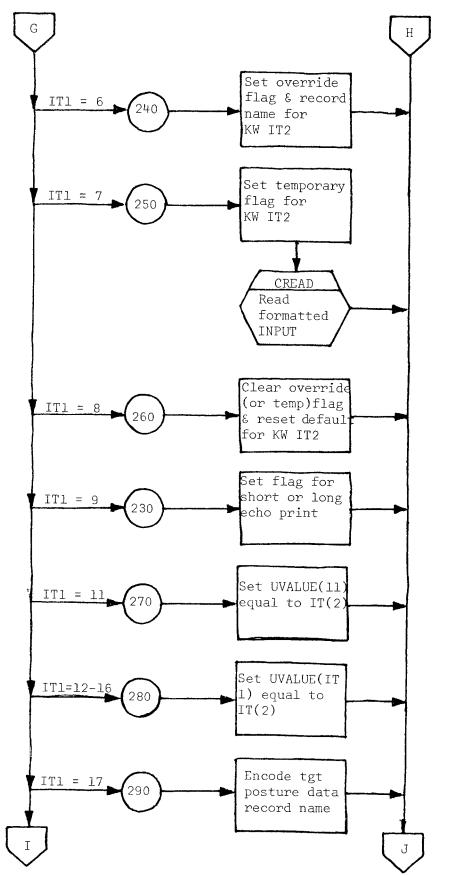


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 6 of 15)

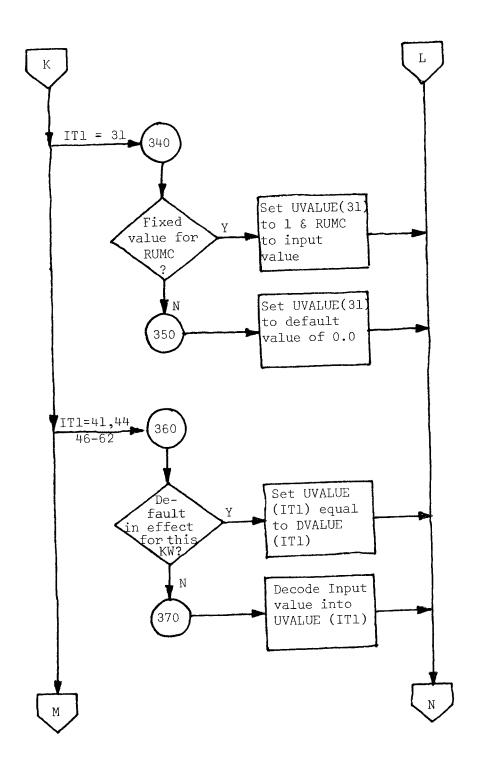


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 8 of 15)

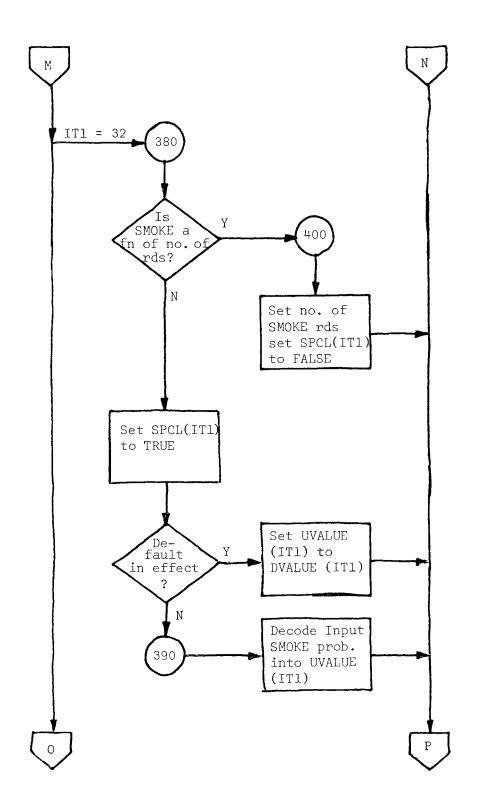


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 9 of 15)

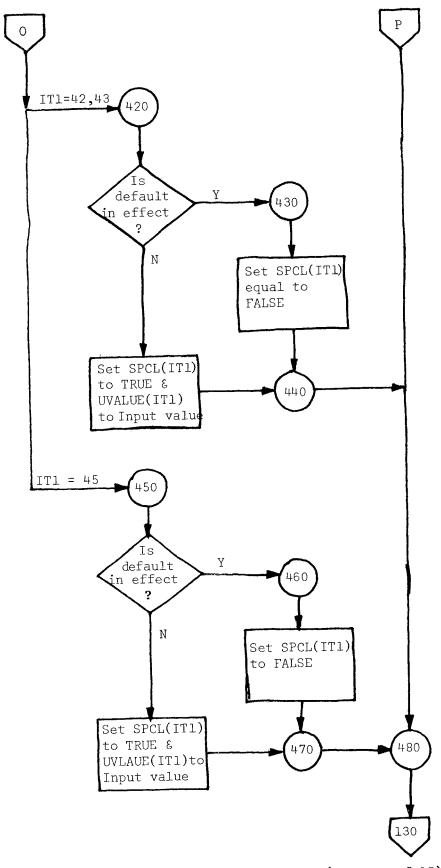


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 10 of 15)

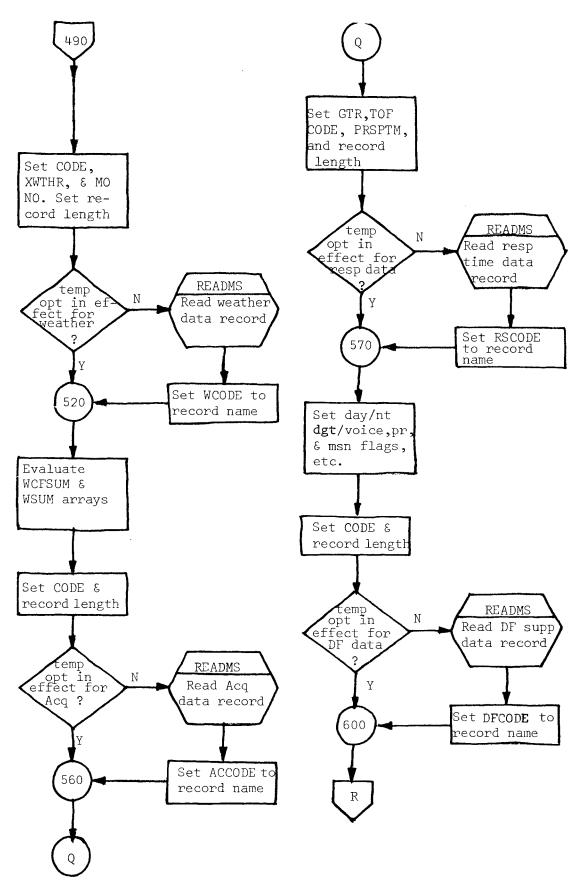


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 11 of 15)

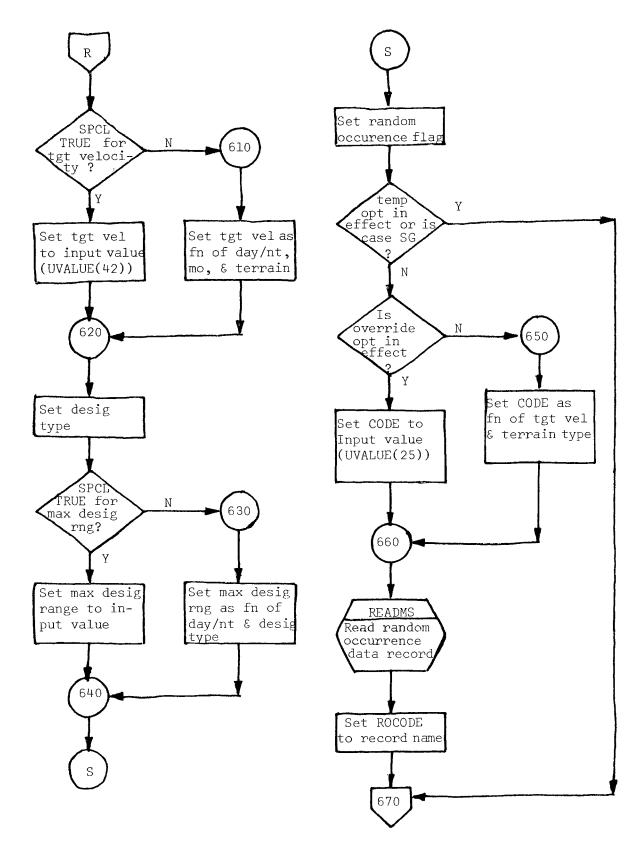


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 12 of 15)

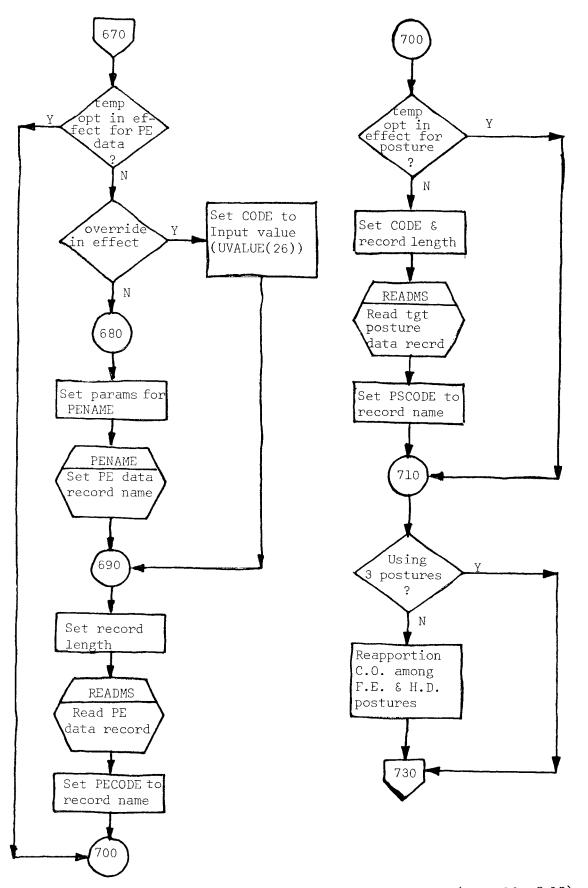


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 13 of 15)

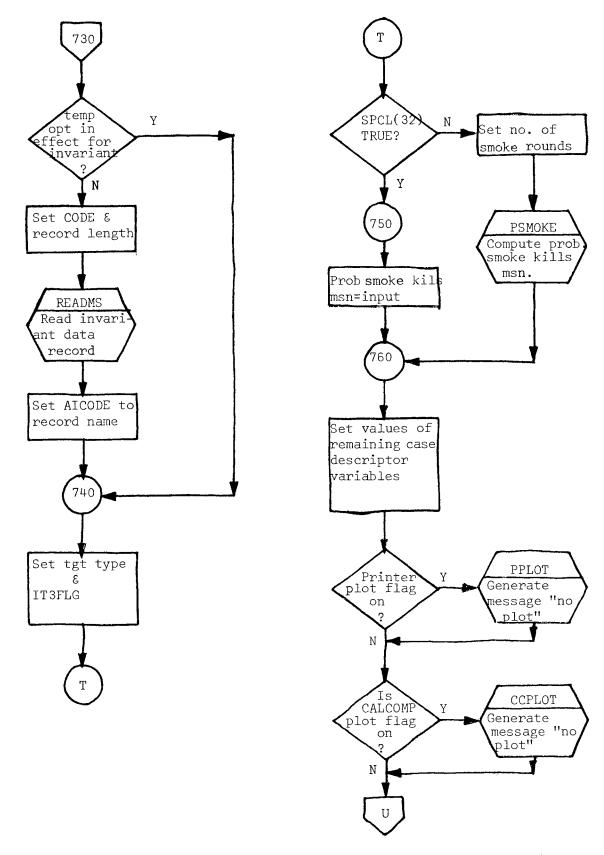


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 14 of 15)

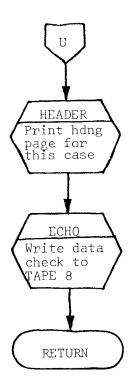


FIGURE 11-2 Flowchart of Subroutine INPUT of COPE (Page 15 of 15)

CHAPTER 12

12. GLOSSARY OF MAIN COPE PROGRAM VARIABLES

This chapter consists of a glossary of variables for the main COPE program. (Glossaries for the PREPMS and PRBLOS preprocessor programs are respectively, included in sections 14.3 and 15.3. No glossary is provided in this report for the PAM preprocessor program.)

The glossary consists of an alphabetical list of the variable names. For each variable name, there is an entry giving VARIABLE, TYPE, COMMON BLOCK, UNITS, and DEFINITION.

Under the VARIABLE heading is the variable name and, if the variable is an array, the array dimensions are given in parentheses after the name.

Under the TYPE column, the variable type is given; if the type is omitted, it means the FORTRAN type default is in effect (i.e., a variable beginning with letter I, J, K, L, M, or N is integer type whereas one beginning with any other letter is single precision real type).

Under the COMMON BLOCK column is the name of the common block (if any) to which the variable belongs. If this column contains "(LOCAL)", it means the variable is a local variable; if it contains "(F.P.)", it means the variable is a formal parameter in a FUNCTION or SUBROUTINE.

Under the UNITS column is the name of the units of measure in which the variable is to be given. If a blank occurs in this column, it means that the variable is unitless.

Finally, under the DEFINITION heading is a brief description of the variable.

GLOSSARY OF MAIN COPE PROCRAM VARIABLES

VARIABLE	TYPE	COMMON BLOCK	UNITS	DEFINITION
A(80) A(N)		(F.P.)		ARRAY INTO WHICH INPUT LINE IS READ BY SUBROUTINE INPUT. A(I) IS THE ITH CHARACTER IN THE INPUT LINE. ALSO USED AS A FORMAL PARAMETER TO RECEIVE COMMENTS IN SUBROUTINE COMMIT OR TO PASS INPUT LINE TO SUBROUTINE SEPREC TO UNSTRING KEYWORDS AND OPTION WORDS.
ABRPCT(20, 6)		(LOCAL)		ABRPCT(I, J) IS THE PERCENT OF THE TOTAL NUMBER OF REPLICATIONS THAT ABORTED FOR ITH ABORT REASON ON ROUND J. IF ABRPCT(I, J) IS UNDEFINED, IT IS SET EQUAL TO -1.
ACCODE		RECNAM		RECORD NAME KEY FOR THE ACQUISITION DATA RECORD LAST READ FROM THE WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
ACQDAT(161)		(LOCAL)		ARRAY TO WHICH ELEMENTS OF ACQUISITION RANGE DATA BLOCK ARE EQUIVALENCED.
ACQLBL(2, 4)		HEADNG		ALPHANUMERIC DESCRIPTOR OF THE TERRAIN TYPE USED FOR CURRENT CASE. IT IS USED TO LABEL THE "TERRAIN AND LOS" BLOCK OF THE OUTPUT HEADING.
AICODE		RECNAM		RECORD NAME KEY FOR THE "INVARIANT" DATA RECORD LAST READ FROM THE WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
AINVDA(167)		(LOCAL)		ARRAY TO WHICH ELEMENTS OF INVARIANT DATA BLOCK ARE EQUIVALENCED.
ALF		(L0CAL)		TEMPORARY NAME FOR THE ALPHA PARAMETER OF THE GAMMA DISTRIBUTION USED TO SAMPLE DIGITAL MESSAGE DEVICE DELAY TIME.
ALFBET(27)		SYMBOL		ALFBET(I) IS THE ITH LETTER OF THE ALPHABET FOR I=1,2,,26 ALFBET(27) IS AN APOSTROPHE. THESE SYMBOLS ARE ALL STORED IN A1 FORMAT.
ALPHA		(F.P.)		ALPHA IS THE 'SHAPING FACTOR' OF THE GAMMA DISTRIBUTION.
ALPHA(2, 2)		RSPTIM		ALPHA(I, J) IS THE ALPHA PARAMETER TO BE USED WITH THE GAMMA DISTRIBUTION (I=1 FOR DAY, I=2 FOR NIGHT, J=1 FOR A PREPLANNED TARGET, AND J=2 FOR A TARGET OF OPPORTUNITY).
ANGLET		PEDESC DE (F.P.)	DEGREES	THE ANGLE BETWEEN THE GUN-TARGET LINE AND THE DESIGNATOR-TARGET LINE.
ANUMBR(11)		SYMBOL		ANUMDR(I)=I-1 FOR 1 <i<10. a="" anumbr(11)="" are="" at="" format.<="" in="" is="" minus="" sign.="" stored="" td="" these=""></i<10.>

(LOCAL) (LOCAL) (LOCAL) (F.P.) (RSPTIM SECONDS RSPTIM SECONDS RSPTIM SECONDS RSPTIM SECONDS RSPTIM SECONDS (LOCAL) (LOCAL) (LOCAL) (LOCAL)
(L (
TYPE (
WARIABLE AOUT (4, 40) AVALUE (9) B(8, 10) B(M, N) BCSPTM(2, 2) BETA(2, 2) BLANK BLORNG BLORNG C(80)

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WEATHR METERS ARRAY OF CLOUD CEILING ALTITUDE VALUES.	(LOCAL) METERS CLOUD CEILING ALTITUDE. (NOT ACTUALLY USED AFTER IT IS SET). THE INDEX OF THE CLOUD CEILING ALTITUDE (ICC) IS THE NUMBER USED TO ACCESS DATA THAT DEPENDS ON CLOUD CEILING ALTITUDE.)	(LOCAL) CHAR(I, J) FOR I>2 CONTAINS CHARACTERS 10*(I-3)+1 THROUGH 10*(I-2) OF THE JTH OPTION WORD CHARACTER STRING IN A10 FORMAT CHARA(1, J) IS THE OPTION WORD CHOICE NUMBER AND CHARA(2, J) IS THE NUMBER INDICATING THE LEVEL (POSITION NUMBER) OF THE OPTION WORD.	ACHAR CHAR(I, J) FOR I>2 CONTAINS CHARACTERS 10*(I-3)+1 THROUGH 10*(I-2) OF THE JTH KEYWORD CHARACTER STRING IN A10 FORMAT. CHAR(1, J) IS THE KEYWORD NUMBER AND CHAR(2, J) IS THE NUMBER OF OPTION WORD CHARACTER STRINGS ALLOWED WITH JTH KEYWORD.	COMMON BLOCK UNITS DEFINITION
(LOCAL) CONTAINS COMMENT LINE GENERATED BY PROGRAM AND READY TO BE PROCESSED BY SUBROUTINE COMMNT. COMENT CMENT(1, J) CONTAINS CHARACTERS 10*(1-1)+1 THROUGH 10*I OF THE JTH LINE OF COMMENTS TO BE PRINTED WITH THE CURRENT CASE (LOCAL) CODE AND ICODE ARE EQUIVALENT. (SEE ICODE)	METERS)	METERS METERS) METERS METERS	L) METERS R METERS L) L)
	METERS)) METERS METERS) METERS) METERS	L) METERS L) METERS R METERS L)
	METERS) METERS) METERS	L) METERS R METERS

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VARIABLE	COMMON BLOCK	UNITS	DEFINITION
DAYLBL(2)	HEADNG		ALPHANUMERIC LABELS USED IN LABELING OUTPUT HEADINGS AS DAY OR NIGHT.
DOT	DVALUE		NOT USED.
DECFLG	(LOCAL)		IF DECFLG=1.0, A DECIMAL POINT HAS BEEN ENCOUNTERED IN C ARRAY; IF DECFLG=0.0. NO DECIMAL POINT HAS BEEN ENCOUNTERED IN C ARRAY.
DECPNT	SYMBOL		ALPHANUMERIC SYMBOL FOR DECIMAL POINT STORED IN A1 FORMAT.
DEFB	PEDESC(LOCAL) IN PENAME)	METERS	DEFLECTION BIAS (DISTANCE FROM FOOTPRINT CENTROID TO POINT OF CLOSEST APPROACH OF TARGET).
DELTAT	(L0CAL)	SECONDS	TIME ROUND ARRIVES ON TARGET MINUS TIME LAST TARGET VEHICLE IN COLUMN PASSES POINT OF CLOSEST APPROACH TO FOOTPRINT CENTROID. IF DELTAT AS COMPUTED ABOVE IS NEGATIVE, THEN A VALUE OF ZERO IS USED.
DESRNG(3, 2)	DESRNG	METERS	DESRNG(I,J) IS THE MAXIMUM DESIGNATOR RANGE FOR THE ITH DESIGNATOR TYPE AND THE JTH DAY OR NIGHT CONDITION (J=1 FOR DAY, J=2 FOR NIGHT).
DETTIM	RSPTIM	SECONDS	TIME FROM TARGET UNMASK TO OBSERVER'S CALL FOR COPPERHEAD.
DETTMA(10, 2)	RSPTIM	NONE, SEC	DETECTION TIME CUMULATIVE DISTRIBUTION ARRAY. DETTMA(I,1) IS THE PROBABILITY THAT DETECTION TIME IS LESS THAN OR EQUAL TO DETTMA(I,2).
DFCODE	RECNAM		RECORD NAME KEY FOR THE DIRECT FIRE DATA RECORD LAST READ FROM THE WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
DFD0KL(10,3)	DODF	METERS, NONE	DFDOKL(I,1) IS THE ITH RANGE CLASS UPPER LIMIT: DFFOKL(I,2) IS THE PROBABILITY THAT DIRECT FIRE OBSCURES DESIGNATOR'S VIEW OF TARGET AT RANGE DFDOKL(I,1) BUT DOES NOT KILL DESIGNATOR: DFDOKL(I,3) IS THE PROBABILITY THAT DIRECT FIRE KILLS THE DESIGNATOR AT RANGE DFDOKL(I,1).
DFSDAT	(LOCAL)	METERS	ARRAY TO WHICH ELEMENTS OF DIRECT FIRE SUPPRESSION DATA BLOCK ARE EQUIVALENCED.
DFSLBL(2,2)	HEADNG		ARRAY CONTAINING LABELS FOR DIRECT FIRE SUPPRESSION LEVEL PRINT OUT.
DGTLBL(2,2)	HEADNG		ARRAY CONTAINING LABELS FOR COMMUNICATIONS PRINT OUT.

GLOSSARY - CONTINUED <u>DEFINITION</u>	DEFAULT COMMUNICATIONS TYPE (DIGITAL).	DEFAULT DAY OR NIGHT TIME (DAY).	MEAN DISTANCE BETWEEN CONSECUTIVE VEHICLES IN TARGET COLUMN.	DISPM(I) IS THE FIRST THREE LETERS OF THE ITH MONTH NAME USED IN PROGRAM. (A3 FORMAT)	DISPT(I) IS THE FOUR DIGIT TIME OF DAY FOR THE ITH TIME OF DAY PLAYED. (A4 FORMAT)	ARRAY OF DELAY TIME VALUES USED FOR INTERPOLATING IN PROB-ABILITY OF ENGAGEMENT ARRAY.	PROBABILITY DESIGNATOR HAS BEEN KILLED BY PREPARATORY ARTILLERY FIRES.	FLAG USED TO INDICATE THAT DESIGNATOR HAS BEEN KILLED BY DIRECT FIRE. (TRUE = KILLED; FALSE = NOT KILLED)	ARRAY OF DESIGNATOR LOCATION LABELS USED FOR PRINT OUT.	DOLLAR SIGN SYMBOL IN AI FORMAT.	DEFAULT VALUE FOR PARAMETERIZED RESPONSE TIME.	DEFAULT NUMBER OF SMOKE ROUNDS FIRED BY RED. DSMK(1) FOR TYPE 1 SMOKE ROUNDS.	DESIGNATOR-TO-TARGET RANGE.	DUMMY VARIABLE NO LONGER USED (BUT RETAINED TO AVOID CHANGING COMMON BLOCK SIZE).	DURATION OF LINE-OF-SIGHT (TIME FROM WHEN FIRST VEHICLE IN COLUMN UNMASKS UNTIL LAST VEHICLE IN COLUMN LEAVES LINE-OF- SIGHT SEGMENT).	DVALUE(I) IS EQUIVALENT TO D(I).	TIME TO ENTER FIRE REQUEST ON DIGITAL MESSAGE DEVICE.	FLAG INDICATING NO FURTHER CASES TO BE READ.	FLAG INDICATING REPLICATION (OR FIRING OF ROUND) IS TO BE ENDED.
GI			METERS			SECONDS					SECONDS		METERS		SECONDS		SECONDS		
COMMON BLOCK	DVALUE	DVALUE	TARGET	DISPLY	DISPLY	HIT	MISC	DODF	HEADNG	SYMBOL	DVALUE	DVALUE	RANGE	RSPTIM	TIME	(LOCAL)	(LOCAL)	FLAG	FLAG
TYPE								LOGICAL										LOGICAL	LOGICAL
VARIABLE	DIDIGT	DIDN	DISBVH	DISPM(12)	DISPT(24)	DLTT(6)	DOARPK	DOKILD	DOLBL(3,2)	DOLLAR	DPRT	DSMK(2)	DTRNG	DUMT	DURLOS	DVALUE (70)	EDDTIM	ENDFLG	ENDREP

<u>DEFINITION</u> USED T9 CALCULATE FDT2.	USED FOR INTERPOLATING WITH RESPECT TO DELAY TIME IN THE PROBABILITY OF ENGAGEMENT TABLES.	FLAG USED TO INDICATE FIRST INPUT LINE IN CHECKING FOR SEQUENCE NUMBERS.	FUNCTION VALUE, SPECIAL FORMATTING OF PERCENTAGES USED FOR PRINT OUT.	USED TO INTERPOLATE WITH RESPECT TO RANGE IN THE DFDOKL ARRAY.	WIDTH OF FRONT WHICH RED WANTS TO SMOKE.	FT SILL'S CUMULATIVE RESPONSE TIME DISTRIBUTION. FSRT(1,1) IS THE PROBABILITY THAT THE TOTAL DESIGNATOR-FDC-BATTERY RESPONSE TIME IS LESS THAN OR EQUAL TO FSRT(1,2).	TOTAL DESIGNATOR-FDC-BATTERY RESPONE TIME AS SAMPLED FROM FSRT ARRAY WHEN USING FT SILL RESPONSE TIME DISTRIBUTION.	FLAG TO INDICATE WHETHER FT SILL RESPONSE TIME DISTRIBUTION IS BEING USED.	FUNCTION VALUE. GAMMA DISTRIBUTED RANDOM VARIABLE.	GUN-TO-TARGET RANGE AS USED IN SUBROUTINE PENAME.	GUN-TO-TARGET RANGE.	HUMID(I) IS THE PROBABILITY THAT THE RELATIVE HUMIDITY FALLS IN CLASS I. (IF I=1, RELATIVE HUMIDITY <65%; IF I=2, RELATIVE HUMIDITY >65%).	USED AS CONTROL VARIABLE IN VARIOUS DO-LOOPS AND IMPLIED DO-LOOPS. ALSO USED AS A FORMAL PARAMETER (RANDOM NUMBER SEED AND SUBSCRIPT) AND A COUNTER.	INDEX NUMBER OF CAUSE OF MISSION (OR ROUND) ABORT.	LENGTH OF ACQUISITION DATA RECORD ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
UNITS					Σ	NONE, SECONDS	SECONDS			Σ X	X S				
(LOCAL)	(LOCAL)	LOGFLG	FUNCTION	(LOCAL)	SMOKED	FSRESP	(LOCAL)	LOGFLG	FUNCTION	(F.P.)	PEDESC	WEATHR	(LOCAL) (F.P.)	(LOCAL) (F.P.)	(LOCAL)
TYPE		L0GICAL						TOGICAL							
VARIABLE	FDT1 FDT2	FIRSTL	FPRCNT	FRAC	FRONT	FSRT(14,2)	FSRTIM	FTSILL	GAMMA	GTR	GTRNG	HUMID(2)	П	IABRT	IACQRL

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VARIABLE	TYPE	COMMON BLOCK	UNITS	DEFINITION
IATENG		(LOCAL)		NUMBER OF ATTEMPTED ENGAGEMENTS FOR THE CURRENT CASE.
IB		(LOCAL & F.P.)		USED AS SECOND SUBSCRIPT OF B ARRAY IN NUMRIC AND FINDIT.
IBAIL		BAIL		FLAG INDICATING WHICH BAIL-OUT CHECK IS BEING MADE. IBAIL=1 INDICATES PRE-COMMUNICATIONS CHECK; IBAIL=2 INDICATES POST- COMMUNICATIONS CHECK.
JC		(LOCAL)		CONTROL VARIABLE FOR IMPLIED DO-LOOP IN DECODE STATEMENT. ALSO AN UNUSED RETURNED PARAMETER FROM A CALL TO SMPLCD.
100		WEATHR		ICC INDICATES WHICH OF THE SIX CLOUD CEILING ALTITUDES IS BEING USED ON THIS REPLICATION. IF CLOUD FREE LINE-OF-SIGHT EXISTS, ICC=1 (HIGHEST CEILING) IS USED.
ICCPFG		RUNDAT		CALCOMP PLOT FLAG. ICCPFG=0 INDICATES NO CALCOMP PLOT HAS BEEN REQUESTED FOR THE CURRENT CASE: ICCPFG=1 INDICATES THAT CALCOMP PLOT OUTPUT HAS BEEN REQUESTED.
ICFLOS		(L0CAL)		CLOUD FREE LINE-OF-SIGHT FLAG. ICFLOS=1 INDICATES A CLOUD FREE LINE-OF-SIGHT; ICFLOS=2 INDICATES NO CLOUD FREE LINE-OF-SIGHT.
ICHNL		(LOCAL)		NUMBER OF OPTION WORDS IN CHARA ARRAY TO BE CHECKED IN SEARCH FOR MATCH WITH OPTION WORDS OF CURRENT KEYWORD.
ICHRRL		(Ť0CAL)	,	NUMBER OF WORDS IN OPTION WORD DATA RECORD ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
ICLASS		(LOCAL) (F.P.)		WHEN A CUMULATIVE DISTRIBUTION IS SAMPLED USING THE SMPLCD SUBROUTINE, THE VALUE RETURNED IN ICLASS IS THE NUMBER OF THE INTERPOLATION INTERVAL FROM WHICH THE SAMPLE WAS OBTAINED.
ICLNGF		(LOCAL)		CLOUD CEILING FLAG. ICLNGF=1 INDICATES A CLOUD CEILING; ICLNGF=2 INDICATES NO CLOUD CEILING (I.E., SCATTERED CLOUDS)
I CMFLG		(LOCAL)		COMMENT FLAG. ICMFLG=O INDICATES NO TIME OF DAY/WEATHER INCONSISTENCY COMMENT WILL BE PRINTED FOR THIS CASE; ICMFLG=1 INDICATES SUCH A COMMENT WILL BE PRINTED.
ICMNT		COMENT		NUMBER OF \$\$ COMMENT LINES TO BE PRINTED FOR THIS CASE.
ICODE		ICODE		RECORD NAME KEY WHEN READING FROM WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11). ICODE IS EQUIVALENT TO CODE.

DEFINITION	INDEX NUMBER USED TO CHECK WHETHER MORE THAN ONE INPUT LINE HAS BEEN READ WITH THE SAME KEYWORD FOR EACH CASE.	ALPHANUMERIC DESCRIPTORS OF CAUSES OF MISSION (OR ROUND) ABORTS. IDABRT(I,J) CONTAINS CHARACERS 10*(I-1)+1 THROUGH 10*I OF ABORT DESCRIPTOR NUMBER J.	FUNCTION VALUE. A NUMERICAL VALUE USED TO INDICATE TO WHICH CLASS OF SYMBOLS A GIVEN CHARACTER BELONGS.	A NUMERICAL VALUE INDICATING TO WHICH CLASS OF SYMBOLS A PARTICULAR CHARACTER BELONGS.	RECORD NAME KEY FOR A PROBABILITY OF ENGAGEMENT DATA RECORD TO BE READ OR INTERPRETED.	SUBSCRIPT OF INDEX ARRAY USED WHEN DELTAT IS ZERO.	SUBSCRIPT OF INDEX ARRAY USED FOR INTERPOLATION WHEN DELTAT IS POSITIVE.	SUBSCRIPT OF INDEX ARRAY USED FOR INTERPOLATION WHEN DELTAT IS POSITIVE (IDELT2=IDELT1+1).	<pre>IDFL=1 INDICATES HIGH LEVEL OF DIRECT FIRE SUPPRESSION; IDFL=2 INDICATES NO DIRECT FIRE SUPPRESSION. (IDFL IS USED TO PRINT CASE HEADING LABELS.)</pre>	DIRECT FIRE SUPPRESSION DATA RECORD LENGTH ON WORD ADDRES-SABLE MASS STORAGE FILE (TAPE 11).	FLAG TO INDICATE WHICH METHOD OF COMMUNICATION IS TO BE FIRST CHOICE WHEN DESIGNATOR CALLS REQUEST FOR FIRE TO FDC. (IDIGTL=1 INDICATES DIGITAL COMMUNICATION; IDIGTL=2 INDICATES VOICE COMMUNICATION.)	FLAG TO INDICATE DAY OR NIGHT. (IDN=1 INDICATES DAYTIME; IDN=2 INDICATES NIGHTTIME.)	FLAG TO INDICATE DESIGNATOR OPERATOR LOCATION. (IDOLOC=1 INDICATES VANTAGE POINT LOCATION; IDOLOC=2 INDICATES MANEUVER UNIT LOCATION).	FLAG TO INDICATE DESIGNATOR TYPE. (IDSGTP=1 INDICATES GLLD, IDSGTP=2 INDICATES MULE, AND IDSGTP=3 INDICATES LTD).
UNITS														
COMMON BLOCK		ABRLBL	FUNCTION	(LOCAL)	(F.P.)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	FLAG	FLAG	(LOCAL)	RSPTIM
TYPE														
VARIABLE	ICRD	IDABRT(3,19)	IDCHAR	IDCHR	IDCODE	IDELTT	IDELT1	I DELT2	IDFL	IDFSRL	IDIGTL	IDN	100100	IDSGTP

DEFINITION	FORMAL PARAMETER INDICATING DESIGNATOR TYPE. VALUES OF 1,2, AND 3 HAVE SAME MEANING AS FOR THE VARIABLE IDSGTP.	COMPUTED GO TO PARAMETER USED TO SEND CONTROL TO SECTION OF SUBROUTINE INPUT THAT HANDLES A PARTICULAR CLASS OF INPUT LINES.	GUN-TO-TARGET RANGE ROUNDED TO NEAREST INTEGER.	USED AS SUBSCRIPT FOR INDEXING PETBL ARRAY. ALSO USED AS DO-LOOP CONTROL VARIABLE.	USED AS SUBSCRIPT FOR INDEXING PETBL ARRAY.	USED AS SUBSCRIPT FOR INDEXING PETBL ARRAY.	CONTROL VARIABLE IN VARIOUS DO-LOOPS.	CONTROL VARIABLE IN DO-LOOP.	DO-LOOP CONTROL VARIABLE IN REINITIALIZING KTEST ARRAY.	CONTROL VARIABLE IN IMPLICIT DO-LOOP.	SUBSCRIPT OF KEYWORD CHARACTER STRING FOUND TO MATCH A CURRENT INPUT LINE CHARACTER STRING.	STORES SUBSCRIPT OF KEYWORD CHARACTER STRING MATCHING FIRST CURRENT INPUT LINE KEYWORD WHILE SECOND KEYWORD IS BEING CHECKED FOR A MATCH (APPLIES ONLY TO "TEMPORARY", "OVERRIDE" AND "RESET" KEYWORDS).	INDEX NUMBER OF MONTH OF CURRENT CASE'S WEATHER DATA. (E.G., IF JUNE AND DECEMBER ARE THE ONLY MONTHS PLAYED, IMNTH=1 FOR JUNE AND IMNTH=2 FOR DECEMBER).	FLAG AND SUBSCRIPT INDICATING WHETHER TARGET IS PAST THE POINT OF CLOSEST APPROACH TO THE CENTROID OF THE FOOTPRINT. (IMUTS=1 IF TARGET IS PAST POINT OF CLOSEST APPROACH; IMUTS=2 IF NOT).	NUMBER OF OPTION WORDS TO BE CHECKED FOR MATCH ON CURRENT INPUT LINE.	NUMBER OF GAMMA DISTRIBUTION RANDOM DEVIATES TO BE RETURNED BY CALL OF IMSL SUBROUTINE GGAMA.
UNITS			Σ													
COMMON BLOCK	(F.P.)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	TARGET	(LOCAL)	(LOCAL)
TYPE																
VARIABLE	IDT	160	IGTR	11	111	112	LJ	Ϋ́	IKTEST	11	IMATCH	IMATCH1	IMNTH	IMUTS	IMXNR	NI

VARIABLE	TYPE	COMMON BLOCK	UNITS	DEFINITION
INDEX(6,5,2)		HIT		INDEXING ARRAY FOR REFERENCING PETBL ARRAY. INDEX(I,J,K) IS THE NUMBER OF THE PETBL TO BE USED FOR CLOUD CEILING I, VISIBILITY RANGE J, AND IMUTS VALUE K.
INDX11(2001)		INDEX1		ARRAY CONTAINING MASTER INDEX FOR WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
INVDRL		(LOCAL)		INVARIANT DATA RECORD LENGTH ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
IOCSN		(LOCAL)		NUMBER OF OCCASIONS FOR THE CURRENT CASE (EQUAL TO NREP).
IOP TNM(70)		(LOCAL)		IOPTNM(I) IS THE NUMBER OF DIFFERENT OPTION WORD CHARACTER STRINGS ALLOWED FOR KEYWORD I.
IOVER(70)		OVER		<pre>IOVER(I)=1 INDICATES "OVERRIDE" OPTION IN EFFECT FOR KEY- WORD I; IOVER(I)=2 INDICATES "TEMPORARY" OPTION IN EFFECT FOR KEYWORD I.</pre>
IPERL		(LOCAL)		PROBABILITY OF ENGAGEMENT DATA RECORD LENGTH ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
IPOINT(70)		POINT		IPOINT(I) IS THE VALUE OF THE COMPUTED GO TO PARAMETER THAT WILL SEND CONTROL THE PROPER PART OF SUBROUTINE INPUT FOR HANDLING KEYWORD I INPUTS.
IPPFG		RUNDAT		PRINTER PLOT FLAG. IPPFG=1 INDICATES PRINTER PLOT OUTPUT REQUESTED FOR THIS CASE; IPPFG=0 INDICATES PRINTER PLOT OUTPUT NOT REQUESTED FOR THIS CASE.
IPREPL		FLAG		PRE-PLANNED TARGET FLAG. IPREPL=1 INDICATES PRE-PLANNED TARGET; IPREPL=2 INDICATES TARGET OF OPPORTUNITY.
IPRINT		(L0CAL)		FLAG TO INDICATE WHETHER CURRENT RANDOM NUMBER SEEDS HAVE YET BEEN WRITTEN TO TAPE 8, IPRINT=0 INDICATES THEY HAVE NOT; IPRINT=1 INDICATES THEY HAVE.
IPRTY		FLAG		PRIORITY FLAG. IPRTY=2 INDICATES PRIORITY PRE-PLANNED TARGET; IPRTY=0 INDICATES NO SPECIAL PRIORITY.
IRAY(6)		(L0CAL)		ARRAY CONTAINING ERROR PROCESSING SPECIFICATIONS FOR CALL OF SYSTEMC SUBROUTINE FOR NON-STANDARD RECOVERY FOR CDC FORTRAN ERROR 104.
IRC		(LOCAL)		UNUSED VALUE RETURNED BY A CALL OF SUBROUTINE SMPLCD.

DEFINITION	INITIAL PARAMETER OF A DO-LOOP (IRF=1).	SUBSCRIPT USED IN INTERPOLATING WITH RESPECT TO RANGE IN RNGTTF ARRAY TO OBTAIN PROBABILITY OF HIT GIVEN AN ENGAGEMENT.	SUBSCRIPT USED IN INTERPOLATING WITH RESPECT TO RANGE IN PSTTBL ARRAY TO OBTAIN PROBABILITIES OF THE VARIOUS TARGET POSTURES. ALSO FORMAL PARAMETER FOR RANDOM NUMBER SEED IN GAMMA.	RANDOM NUMBER SEED TO BE USED WHEN CALLING URAN31 FROM SMPLCD.	RANDOM OCCURRENCE FLAG. IRNDOC=1 INDICATES RANDOM OCCURRENCE LINE-OF-SIGHT METHODOLOGY USED FOR THIS CASE; IRNDOC=0 INDI- CATES SHOOTING GALLERY LOS METHODOLOGY USED FOR THIS CASE.	LOWER LIMIT OF RANGE BRACKET USED TO INTERPOLATE IN PETBL ARRAY.	UPPER LIMIT OF RANGE BRACKET USED TO INTERPOLATE IN PETBL ARRAY.	RANDOM OCCURRENCE DATA RECORD LENGTH ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).	NUMBER OF THE ROW OF THE SEGLOS ARRAY TO BE USED IN SAMPLING FOR LINE-OF-SIGHT SEGMENT LENGTH ON THIS REPLICATION.	RESPONSE TIME DATA RECORD LENGTH ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).	ARRAY OF RANDOM NUMBER SEEDS. IR(1) IS EQUIVALENT TO IR1, IR(2) TO IR2, , IR(28) TO IR28.	RANDOM NUMBER SEEDS. IR1 IS SEED FOR FIRST RANDOM NUMBER STREAM, IR2 FOR SECOND, ETC.	NUMBER OF REPLICATIONS OF CURRENT CASE THAT REACHED THE STAGE IN THE MISSION WHERE A ROUND WAS FIRED.	DO-LOOP INITIAL PARAMETER. ISTART IS THE SUBSCRIPT FOR THE FIRST LINE TO BE READ FROM CARDS AS RESULT OF A "TEMPORARY" OPTION FOR PEDATA.
UNITS						₩ ¥	Κ							
COMMON BLOCK	(LOCAL)	(LOCAL)	(LOCAL) (F.P.)	(F.P.)	FLAG	(LOCAL)	(L0CAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	RANDOM	(LOCAL)	(LOCAL)
TYPE														
VARIABLE	IRF	IRM	IRN	IRNDM	IRNDOC	I RNG1	IRNG2	IRORL	IROW	IRSPRL	IR(28)	IR1, IR2,, IR28	ISHOT	ISTART

DEFINITION	<pre>IT(1) = NUMBER OF CURRENT INPUT LINE'S KEYWORD. IT(J) IS THE NUMBER OF THE (J-1)ST OPTION WORD CHOICE OF THE CURRENT LINE FOR J>1.</pre>	FLAG FOR CURRENT COMMUNICATIONS MODE. ITDGTL=1 FOR DIGITAL; ITDGTL=2 FOR VOICE.	TARGET POSTURE FLAG. ITGTPS=1 FOR FULLY EXPOSED TARGET; \times ITGTPS=2 FOR HULL DEFILADE TARGET.	TARGET TYPE NUMBER. ITGTTP=1 FOR TARGET TYPE 1, ITGTTP=2 FOR TARGET TYPE 2, ETC.	ITIMDL=1 INDICATES FIRST METHOD OF MODELING RESPONSE TIME IS PLAYED (SINGLE DISTRIBUTION SAMPLED); ITIMDL=2 INDICATES SECOND METHOD OF MODELING RESPONSE TIME IS PLAYED (SINGLE VALUE USED); ITIMDL=3 INDICATES THIRD METHOD OF MODELING RESPONSE TIME IS PLAYED (ADDING CONTRIBUTIONS OF INDIVIDUAL DELAY COMPONENTS).	TARGET POSTURE DATA RECORD LENGTH FOR WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).	SUBSCRIPT INDICATING TERRAIN TYPE USED FOR CURRENT CASE. USED TO REFERENCE ACQLBL ARRAY FOR OUTPUT HEADING.	FLAG USED TO INDICATE WHETHER CURRENT ATTEMPT TO MATCH KEY-WORD IS FOR FIRST OR SECOND KEYWORD OF CURRENT INPUT LINE. APPLIES ONLY TO "TEMPORARY", "OVERRIDE", AND "RESET" FIRST KEYWORDS.	TARGET VELOCITY.	COMPUTED GO TO PARAMETER USED TO SEND CONTROL TO PROPER READ STATEMENTS WHEN "TEMPORARY" OPTION IS USED.	NUMBER OF CURRENT IMPUT LINE'S FIRST KEYWORD.	NUMBER OF CURRENT INPUT LINE'S SECOND KEYWORD OR FIRST OPTION WORD.	NUMBER OF CURRENT INPUT LINE'S SECOND OPTION WORD.	FLAG USED TO INDICATE WHETHER RUMC IS TO BE CONSTANT. IF IT3FLG=0, RUMC VARIES FROM REPLICATION TO REPLICATION; IF IT3FLG=1, RUMC IS CONSTANT.
UNITS									METERS/SEC					
COMMON BLOCK	(LOCAL)	(LOCAL)	TARGET	TARGET	(FOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL) M	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	FLAG
TYPE														
VARIABLE	11(10)	ITDGTL	ITGTPS	ITGTTP	ITIMDL	ITPSRL	ITRRN	ITRY	ITVEL	ITYPE	III	112	173	IT3FLG

DEFINITION	LOGICAL UNIT NUMBER TO WHICH OUTPUT OF SUBROUTINE ECHO IS TO BE WRITTEN. ALSO UNIT FROM WHICH "TEMPORARY" OPTION PEDATA IS TO BE READ IN SUBROUTINE CREAD.	VISIBILITY RANGE LIMIT FOR THIS REPLICATION.	VISIBILITY RANGE SUBSCRIPT VALUE FOR REFERENCING PETBL ARRAY (IVLA=IVL EXCEPT THAT IF IVL>10, THEN IVLA=10).	COUNTER INDICATING POSITION NUMBER OF THE KEYWORD OR OPTION WORD CURRENTLY BEING ANALYZED IN THE SEPREC SUBROUTINE.	WEATHER DATA RECORD LENGTH ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).	COUNTER USED IN SEPREC SUBROUTINE SEPARATION ALGORITHM.	IXXX=1 INDICATES GOOD WEATHER (CURRENTLY JUNE AND SEPTEMBER) IXXX=2 INDICATES BAD WEATHER (CURRENTLY MARCH AND DECEMBER) IXXX GOVERNS THE VALUE OF THE VELTBL ARRAY TO BE USED IN THE CURRENT CASE. (APPLICABLE ONLY IF TARGET VELOCITY DEFAULT IS IN EFFECT.)	CONTROL PARAMETER FOR IMPLIED DO-LOOPS.	CONTROL PARAMETER FOR IMPLIED DO-LOOPS. ALSO RECEIVING ARGU- MENT FOR DESIGNATOR TYPE IN CALL OF PEIDNT.	CONTROL VARIABLE IN VARIOUS DO-LOOPS. ALSO USED IN CALCULA- TION OF RANDOM NUMBER IN URAN31 AND AS A COUNTER IN SEPREC.	DO-LOOP MAXIMUM LIMIT (NUMBER OF DIFFERENT WIND SPEEDS USED IN SMOKE CALCULATION FOR THIS PASQUILL CATEGORY).	DO-LOOP CONTROL VARIABLE.	CONTROL VARIABLE FOR DO-LOOPS AND IMPLIED DO-LOOPS.	CONTROL VARIABLE FOR DO-LOOP.	CONTROL VARIABLE FOR IMPLICIT DO-LOOP.	CONTROL VARIABLE FOR VARIOUS DO-LOOPS AND IMPLICIT DO-LOOPS. ALSO USED IN CALCULATING INITIAL RANDOM NUMBER SEEDS.
UNITS		ΚM														
COMMON BLOCK	(F.P.) (LOCAL)	WEATHR	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)
TYPE																
VARIABLE	IUNIT	IVL	IVLA	MI	IWTHRL	IX	XXXI	П	12	ņ	JEND	JJ	JK	JKTEST	JL	¥

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VARIABLE	TYPE	COMMON BLOCK	UNITS	DEFINITION
NC(80)		(LOCAL)		NC(I) IS THE NUMBER INDICATING WHICH TYPE OF SYMBOL THE ITH CHARACTER OF THE CURRENT INPUT LINE IS. (O INDICATES NUMERAL OR MINUS SIGN, I INDICATES LETTER OR APOSTROPHE, 2 INDICATES DECIMAL POINT, 3 INDICATES BLANK, 4 INDICATES SEPARATOR, 5 INDICATES A DOLLAR SIGN, AND 6 INDICATES ANY OTHER CHARACTER.)
NCASE		RUNDAT		SEQUENCE NUMBER OF CASE CURRENTLY BEING EXECUTED IN THIS PROGRAM RUN.
NCC		WEATHR		NUMBER OF DIFFERENT CLOUD CEILING ALTITUDE VALUES USED IN WEATHER DATA.
NCODE		(LOCAL)		USED IN CREATING AND DECIPERING PEDATA RECORD NAME.
NCPR(10)		(LOCAL)		NCPR(I) IS THE NUMBER OF CHARACTERS IN THE ITH LINE OF THE B ARRAY (ITH FIELD ON INPUT LINE AFTER COMPRESSING MOST BLANKS AND POSSIBLY ADDING DECIMAL POINTS).
NCRD(70)		(LOCAL)		NCRD(I) IS THE NUMBER OF INPUT LINES READ FOR THE CURRENT CASE THAT DETERMINE THE OPTIONS USED WITH KEYWORD NUMBER I.
NDFSP		DODF		NUMBER OF RANGE POINTS USED IN DIRECT FIRE SUPPRESSION DISTRIBUTION (DFDOKL ARRAY).
NDOKIL		DODF		NUMBER OF REPLICATIONS IN WHICH DESIGNATOR OPERATOR HAS BEEN KILLED FOR CURRENT CASE.
NDR		(F.P.)		INDICATES NUMBER OF POINTS USED IN DEFINITION OF CUMULATIVE DISTRIBUTION FUNCTION NOW BEING SAMPLED.
NDRM1		(LOCAL)		MAXIMUM LIMIT ON DO-LOOP. (EQUALS NDR-1).
NDT		RSPTIM		NUMBER OF POINTS USED IN DETECTION TIME DISTRIBUTION.
LGN		(F.P.)		FIRST DIMENSION OF ARRAY WHOSE ELEMENTS DEFINE CUMULATIVE DISTRIBUTION BEING SAMPLED.
ND2		(F.P.)		SECOND DIMENSION OF ARRAY WHOSE ELEMENTS DEFINE CUMULATIVE DISTRIBUTION BEING SAMPLED.
NKILL (6)		(LOCAL)		NKILL(I) IS THE NUMBER OF REPLICATIONS IN WHICH THE ITH ROUND OF THE FIRE MISSION KILLED A VEHICLE FOR THE CURRENT CASE.
NLRTC		(LOCAL)		NUMBER OF INPUT LINES READ SO FAR FOR THE CURRENT CASE.

VARIABLE	TYPE	COMMON BLOCK	UNITS	DEFINITION
NP(9)		(LOCAL)		USED TO CONSTRUCT THE PEDATA RECORD NAME. NP(I) IS THE INDEX NUMBER (IN THE XVALUE ARRAY) OF THE CURRENT VALUE OF THE ITH PARAMETER OF THE PEDATA RECORD NAME.
NPLOSR		RANDOC		NUMBER OF RANGE POINTS USED IN THE PROBABILITY OF LINE-OF-SIGHT FOR RANDOM OCCURRENCE (RNGPLS ARRAY).
NPP		RNGLOS		NUMBER OF POINTS USED IN DEFINING CUMULATIVE DISTRIBUTIONS FOR LINE-OF-SIGHT SEGMENT LENGTHS.
NRE		(LOCAL)		NUMER OF KEYWORDS AND OPTION WORDS ENCOUNTERED ON CURRENT INPUT LINE.
NREC		ACHAR		NUMBER OF DIFFERENT KEYWORD CHARACTER STRINGS ALLOWED AS INPUTS.
NREP		RPLCTN		NUMBER OF REPLICATIONS TO BE DONE FOR THE CURRENT CASE.
NRF		RPLCTN		NUMBER OF ROUNDS (SHOTS) TO BE FIRED FOR EACH REPLICATION (POTENTIAL FIRE MISSION SAMPLE) FOR THIS CASE.
NRNGCB		(LOCAL)		NUMBER OF ROWS TO BE READ INTO SEGLOS DISTRIBUTION.
NRNGCL		RNGLOS		NUMBER OF RANGE CLASSES INTO WHICH LINE-OF-SIGHT SEGMENT LENGTH DATA IS DIVIDED.
NRNGP1		(LOCAL)		MAXIMUM LIMIT ON DO-LOOP. (EQUALS NRNGPS)
NRNGPS		HIT		NUMBER OF RANGE POINTS FOR WHICH TARGET POSTURE DATA IS ENTERED IN RNGPST ARRAY.
NRNGTT		HIT		NUMBER OF RANGE POINTS FOR WHICH "TRUE TARGET FACTOR" DATA IS ENTERED IN RNGTTF ARRAY.
NRP		RNGLOS		NUMBER OF POINTS USED IN CUMULATIVE ACQUISITION RANGE DISTRIBUTION TABLE (CRNGD ARRAY).
NRS		(F.P.)		ROW OF A ARRAY IN WHICH INTERPOLATION IS TO BE PERFORMED TO OBTAIN RANDOM VARIABLE VALUE IN SUBROUTINE SMPLCD.
NSMK2		SMOKED	TYPE 1 SMOKE ROUNDS	NUMBER OF TYPE 1 SMOKE ROUNDS FIRED BY RED TO CREATE SMOKE SCREEN.
NSMK5		SMOKED	TYPE 2 SMOKE ROUNDS	NUMBER OF TYPE 2 SMOKE ROUNDS FIRED BY RED TO CREATE SMOKE SCREEN.

VARIABLE	TYPE	COMMON BLOCK UNITS	DEFINITION
NTEST(20,6)		(LOCAL)	NTEST(I,J) IS THE NUMBER OF TIMES ABORT CONDITION I HAS BEEN TESTED FOR ROUND J FOR THIS CASE. FOR I< MSABLM, NTEST(I,J) = NTEST(J,I) FOR J>1.
NTRC		COMENT	NUMBER OF "TRIPLE \$" COMMENTS READ AND WRITTEN WITH CURRENT CASE.
NUMRIC	LOGICAL	FUNCTION VALUE	TRUE, IF THE ITEM TESTED IS NUMERIC (CONTAINS ONLY NUMERALS, "-", AND "." AS SYMBOLS); FALSE, IF ITEM IS NOT NUMERIC.
NVEHCL		TARGET	NUMBER OF VEHICLES IN TARGET UNIT.
NVEHKL		RPLCTN	NUMBER OF VEHICLES KILLED BY COPPERHEAD THUS FAR IN CURRENT REPLICATION. (APPLIES ONLY TO RANDOM OCCURRENCE LINE-OF-SIGHT OPTION).
NNL		WEATHR	NUMBER OF DIFFERENT METEOROLOGICAL VISIBILITY RANGE LIMITS USED WITH WEATHER DATA.
NXTLIN		(LOCAL)	COUNTER USED IN KEEPING TRACK OF LINE NUMBERS IN PRINTING OF CASE HEADING OUTPUT.
N		(F.P.)	VARIABLE ARRAY DIMENSION.
N2		(F.P.)	VARIABLE ARRAY DIMENSION.
N3		(F.P.)	VARIABLE ARRAY DIMENSION.
OUT(6)		(LOCAL)	ARRAY USED TO STORE ITEMS ABOUT TO BE WRITTEN ON THE PRINTOUT.
PAREN	LOGICAL	(F.P.)	FLAG TO INDICATE WHETHER A RIGHT PARENTHESIS IS TO BE INCLUDED IN FORMATING A PERCENTAGE. (TRUE INDICATES PARENTHESIS IS TO BE INCLUDED; FALSE INDICATES IT IS NOT).
PASPCT(20,6)		(L0CAL)	PASPCT(I,J) IS THE PERCENTAGE OF REPLICATIONS TESTED AT ABORT CONDITION I THAT PASSED (DID NOT ABORT) FOR ROUND J. (IF I< MSABLM, PASPCT(I,J) = PASPCT(I,1) FOR J>1; IF NTEST(I,J)=0, PASPCT(I,J) IS SET TO -1).
PASQL (6)		WEATHR	PASQL(I) IS THE PROBABILITY OF OCCURRENCE OF PASQUILL ATMOSPHERIC STABILITY CATEGORY I FOR THE CURRENT CASE'S WEATHER CONDITIONS.
PASQT		(L0CAL)	THE PASQL VALUES ARE GROUPED IN PAIRS. PASQT IS THE SUM OF PASQL(2*I-1) AND PASQL(2*I) FOR THE CURRENT VALUE OF I.

DEFINITION	PB(I,J) IS THE ITH CHARACTER OF THE JTH KEYWORD OR OPTION WORD OF THE CURRENT INPUT LINE.	PROBABILITY THAT THE DESIGNATOR-TO-FDC CALL-FOR-FIRE MESSAGE CONTAINS THE CORRECT FIRE MISSION INFORMATION AND IS CORRECTLY INTERPRETED.	PROBABILITY THAT DESIGNATOR OPERATOR IS KILLED BY DIRECT FIRE FROM TARGET VEHICLE.	PROBABILITY THAT DESIGNATOR OPERATOR IS SUPPRESSED DUE TO OBSCURANTS CREATED BY NEAR MISSES CAUSED BY DIRECT FIRE FROM TARGET VEHICLE.	PROBABILITY THAT DUST FROM HE ARTILLERY FIRE IS SUFFICIENT TO OBSCURE TARGET AND PREVENT USE OF COPPERHEAD.	PROBABILITY THAT ROUND ENGAGES TARGET (I.E., SUFFICIENT REFLECTED LASER ENERGY IS PICKED UP BY THE SEEKER AND THE TARGET IS WITHIN THE MANEUVER FOOTPRINT OF THE COPPERHEAD ROUND).	USED TO DECIPHER PEDATA RECORD NAME FOR CASE HEADING OUTPUT.	RECORD NAME KEY FOR PROBABILITY OF ENGAGEMENT DATA RECORD ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).	ARRAY TO WHICH THE ELEMENTS OF THE PROBABILITY OF ENGAGEMENT (PE) DATA BLOCK ARE EQUIVALENCED.	PETBL(I,J,K) IS THE PROBABILITY THAT THE COPPERHEAD ROUND ENGAGES THE TARGET GIVEN INDEX VALUE I, VISIBILITY RANGE LIMIT J, AND DESIGNATOR TARGET RANGE K.	PROBABILITY OF ENGAGEMENT VALUE FOR TIME 1 AND RANGE 1 WHEN INTERPOLATING IN PROBABILITY OF ENGAGEMENT DATA WITH IMUTS=1	SAME AS PETIRI BUT FOR TIME I AND RANGE 2.	SAME AS PETIRI BUT FOR TIME 2 AND RANGE 1.	SAME AS PETIRI BUT FOR TIME 2 AND RANGE 2.	LOWER RANGE PROBABILITY OF ENGAGEMENT VALUE WHEN INTERPOLA- TING WITH RESPECT TO RANGE IN PROBABILITY OF ENGAGEMENT DATA WITH IMUTS=2.
UNITS															
COMMON BLOCK	(LOCAL)	RSPTIM	(LOCAL)	(LOCAL)	MISC	(FOCAL)	(LOCAL)	RECNAM	(LOCAL)	HIT	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(L0CAL)
TYPE															
VARIABLE	PB(80,10)	PCRMSG	PDOKIL	PDOSUP	PDSTKL	PE	PECHK	PECODE	PEDATA(4260)	PETBL(60,10,7)	PETIRI	PET1R2	PET2R1	PET2R2	PE1

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GLOSSARY	

TTS DEFINITION	UPPER RANGE PROBABILITY OF ENGAGEMENT VALUE WHEN INTERPOLA- TING WITH RESPECT TO RANGE IN PROBABILITY OF ENGAGEMENT DATA WITH IMUTS=2.	PROBABILITY ROUND HITS TARGET GIVEN THAT ROUND ENGAGES.	PROBABILITY ROUND KILLS TARGET VEHICLE GIVEN THAT ROUND HITS TARGET VEHICLE.	PKTBL(I,J) IS THE PROBABILITY OF KILL GIVEN A HIT FOR COPPERHEAD AGAINST TARGET TYPE I IN TARGET POSTURE J.	USED TO BRACKET UNIFORM RANDOM NUMBER IN A WEATHER CLASS PROBABILITY TABLE.	PROBABILITY OF ATTEMPTED ENGAGEMENT GIVEN AN OCCASION.	PROBABILITY OF KILL GIVEN AN ATTEMPTED ENGAGEMENT.	PROBABILITY OF KILL GIVEN AN OCCASION.	PROBABILITY OF KILL GIVEN A SHOT.	PRBLOS(I) IS THE PROBABILITY THAT A SINGLE VEHICLE LOCATED AT RANDOM ALONG AN APPROACH PATH IN RANGE BRACKET I WILL BE WITH IN THE DESIGNATOR OPERATOR'S LINE-OF-SIGHT FOR AT LEAST THE CRITICAL TIME (TCRIT SECONDS).	PROBABILITY OF SHOT GIVEN AN ATTEMPTED ENGAGEMENT.	PROBABILITY OF SHOT GIVEN AN OCCASION.	PRCFLS(I) IS THE PROBABILITY OF CLOUD FREE LINE-OF-SIGHT GIVEN CONDITION I. (I=1 INDICATES A CLOUD CEILING; I=2 INDICATES SCATTERED CLOUDS ONLY).	PROBABILITY THAT THERE IS A CLOUD CEILING.	PROBABILITY DESIGNATOR KILLED BY DIRECT FIRE GIVEN THAT DIRECT FIRE OCCURRED.	PROBABILITY DESIGNATOR KILLED GIVEN AN OCCASION	PROBABILITY THAT THE DESIGNATOR-OPERATOR IS WARNED TO BEGIN LASING IN TIME TO GUIDE THE FIRST ROUND OF THE FIRE MISSION
COMMON BLOCK	(LOCAL)	(LOCAL)	(LOCAL)	HIT	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	RANDOC	(LOCAL)	(LOCAL)	WEATHR	WEATHR	(L0CAL)	(LOCAL)	RSPTIM
VARIABLE	PE2	Н	곳	PKTBL(10,2)	PR	PRBAEO	PRBKAE	PRBKO	PRBKS	PRBLOS(10)	PRBSAE	PRBS0	PRCFLS(2)	PRCLCG	РРОКС	PRDOKL	PRDOW

DEFINITION	PRGCFL(I,J) IS THE PROBABILITY OF METEOROLOGICAL VISIBILITY RANGE LIMIT I GIVEN CLOUD FREE LINE-OF-SIGHT AND CONDITION J (J=1 INDICATES CLOUD CEILING; J=2 INDICATES SCATTERED CLOUDS)	PRHLOS(I) IS THE PROBABILITY THE LINE-OF-SIGHT EXISTS FROM DESIGNATOR TO TARGET FOR ROUND I. (I.E., LOS EXISTS BOTH BEFORE FIRING AND DURING TERMINAL PHASE OF TRAJECTORY).	PROBABILITY THAT AT LEAST ONE TARGET IS IN VIEW FOR THE CRITICAL TIME (TCRIT SECONDS) DURING THE TERMINAL PHASE OF THE COPPERHEAD TRAJECTORY.	PROBABILITY OF LINE-OF-SIGHT TO A SINGLE TARGET FOR THE CRITICAL TIME DURATION (TCRIT SECONDS) DURING THE TERMINAL PHASE OF THE COPPERHEAD TRAJECTORY.	PROBABILITY THAT DESIGNATOR TO FDC DIGITAL COMMUNICATION LINK IS OPERATING SUCCESSFULLY.	PARAMETERIZED RESPONSE TIME.	PROBABILITY THAT DESIGNATOR TO FDC VOICE COMMUNICATION IS SUCCESSFUL.	USED TO BRACKET RANDOM NUMBER IN A WEATHER CLASS PROBABILITY TABLE.	NAME RECORD KEY FOR TARGET POSTURE DATA RECORD ON WORD ADDRESSABLE RANDOM ACCESS MASS STORAGE FILE (TAPE 11).	PROBABILITY THAT SMOKE ABORTS POTENTIAL COPPERHEAD FIRE MISSION.	ARRAY TO WHICH THE ELEMENTS OF THE TARGET POSTURE DISTRIBUTION DATA BLOCK ARE EQUIVALENCED.	PSTTBL(I,J) IS THE PROBABILITY THAT A MOVING TARGET AT RANGE I IS IN POSTURE J (WHERE J=1 INDICATES A COMPLETELY OBSCURED TARGET, J=2 INDICATES A FULLY EXPOSED TARGET, AND J=3 INDICATES A HULL DEFILADE TARGET).	PSTVAL(I) IS THE PROBABILITY THAT THE TARGET IS IN POSTURE I WHERE I=1,2 AND 3 RESPECTIVELY INDICATE THAT THE TARGET IS COMPLETELY OBSCURED, FULLY EXPOSED, AND HULL DEFILADE.	GAMMA RANDOM DEVIATE.
UNITS						SECONDS								
COMMON BLOCK	WEATHR	(LOCAL)	(LOCAL)	(LOCAL)	RSPTIM	RSPTIM	RSPTIM	(LOCAL)	RECNAM	SMOKED	(LOCAL)	HIT	(L0CAL)	(LOCAL)
TYPE														
VARIABLE	PRGCFL(11,2)	PRHLOS(6)	PRIV	PRLOS	PRSDT	PRSPTM	PRSVT	PR1	PSCODE	PSMKKL	PSTDAT(41)	PSTTBL(10,3)	PSTVAL(3)	R(1)

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VARIABLE	TYPE	COMMON BLOCK	UNITS	DEFINITION
RECLBL(8)		DISPLY		RECLBL(I) IS AN ALPHANUMERIC CODE THAT FORMS PART OF THE RECORD NAME KEY FOR WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11) RECORDS OF TYPE I. (WHICH CORRESPOND TO KEYWORD 20+I).
REFL		PEDESC (F.P.)		REFLECTIVITY OF TARGET TO LASER ENERGY IN DESIGNATOR WAVE LENGTH.
RELIF		MISC		ROUND IN FLIGHT RELIABILITY. PROBABILITY THAT ROUND FUNCTIONS CORRECTLY.
RN		(LOCAL)		UNIFORMLY DISTRIBUTED RANDOM NUMBER.
RNDREC(6)		sccss		RNDREC(I) IS THE NUMBER OF TARGETS KILLED FOR THE CURRENT CASE BY THE ITH ROUND. (RNDREC(I) = $NKILL(I)$.)
RNGCLB(11)		RNGLOS	METERS	RNGCLB(I) IS THE UPPER BOUNDARY OF THE ITH RANGE CLASS FOR LINE-OF-SIGHT SEGMENT LENGTHS.
RNGK		(LOCAL)	×Χ	RNGK IS THE CURRENT DESIGNATOR-TO-TARGET RANGE IN KILOMETERS
RNGNOW		(LOCAL)	METERS	CURRENT DESIGNATOR-TO-TARGET RANGE IN METERS.
RNGPLS(10)		RANDOC	METERS	RNGLOS(I) IS THE UPPER BOUNDARY OF THE ITH RANGE CLASS OF PRBLOS ARRAY.
RNGPST(10)		HIT	METERS	RNGPST(I) IS THE DESIGNATOR-TO-TARGET RANGE FOR THE ITH POSTURE BREAKDOWN DISTRIBUTION IN THE PSTTBL ARRAY.
RNGTTF(20)		HIT	METERS	RNGTTF(I) IS THE DESIGNATOR-TO-TARGET RANGE FOR THE ITH SET OF "TRUE TARGET FACTORS" IN THE TTF ARRAY.
RN1, RN2, RN22		(LOCAL)		THE RANDOM NUMBERS RESULTING FROM CALLS OF URAN31 (I.E., RNi=URAN31 (IRi)) SOME OF THE RN'S (RN9 FOR EXAMPLE) ARE NO LONGER PRESENT IN THE PROGRAM).
ROCODE		RECNAM		RECORD NAME KEY FOR RANDOM OCCURRENCE DATA RECORD ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
RODATA(22)		(LOCAL)		ARRAY TO WHICH THE ELEMENTS OF THE RANDOM OCCURRENCE DATA BLOCK ARE EQUIVALENCED.
ROLBL(4,2)		HEADNG		ARRAY OF ALPHANUMERIC CONSTANTS USED TO CREATE LABELING OF LOS MODE SECTION OF OUTPUT.
RSCODE		RECNAM		RECORD NAME KEY FOR RESPONSE TIME DATA RECORD ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).

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DEFINITION	ARRAY TO WHICH THE ELEMENTS OF THE RESPONSE TIME DATA BLOCK ARE EQUIVALENCED.	ARRAY OF ALPHANUMERIC CONSTANTS USED TO CREATE LABELING OF RESPONSE TIME SECTION OF OUTPUT.	RANGE FROM TARGET UNMASK TO FOOTPRINT CENTROID.	LENGTH OF LINE-OF-SIGHT SEGMENT DRAWN FOR THE CURRENT REPLICATION.	SEGLOS(I,J) FOR J=1 IS THE ITH PROBABILITY VALUE USED FOR BRACKETING A UNIFORM RANDOM NUMBER WHEN INTERPOLATING IN CUMULATIVE LOS SEGMENT LENGTH DISTRIBUTION. SEGLOS(I,J) FOR J>1 IS THE ITH LINE-OF-SIGHT SEGMENT LENGTH VALUE USED FOR INTERPOLATING IN RANGE CLASS J-1. (SEGLOS(I,1) IS THE PROBABILITY THAT A LINE-OF-SIGHT SEGMENT IN RANGE CLASS J-1 IS LESS THAN OR EQUAL TO SEGLOS(I,J).	AN ARRAY OF ALPHANUMERIC SYMBOLS THAT CAN BE USED AS KEYWORD OR OPTION WORD SEPARATORS (",","(",")", ",","?") THEY ARE STORED IN A1 FORMAT.	FLAG TO INDICATE WHETHER SEQUENCE NUMBERS (FROM CDC EDITOR) ARE PRESENT IN COLUMNS 73-78 OF INPUT FILE. (TRUE INDICATES SEQUENCE NUMBERS; FALSE INDICATES NO SEQUENCE NUMBERS).	FLAG TO INDICATE WHETHER SHORT OR LONG FORM OF SUBROUTINE ECHO'S OUTPUT IS TO BE USED. (SHRTEC=TRUE FOR SHORT FORM; SHRTEC=FALSE FOR LONG FORM).	COPPERHEAD SEEKER SENSITIVITY.	FLAG TO INDICATE WHETHER A COMMENT IS A PROGRAM GENERATED "TRIPLE \$" COMMENT. (IF TRUE, IT IS; IF FALSE, IT IS NOT).	VERSION NUMBER OF PROGRAM (INCREASED AS PROGRAM IS MODIFIED)	SMK2(I,J,K) IS THE NUMBER OF TYPE I SMOKE ROUNDS REQUIRED TO CREATE A SMOKE SCREEN FOR 30 MINUTES ACROSS I KILOMETER OF FRONT SUFFICIENT TO PREVENT THE USE OF COPPERHEAD AGAINST TARGETS IN THE SMOKED AREA GIVEN PASQUILL ATMOSPHERIC STABILITY CATEGORY 2*I OR 2*I-1, WIND SPEED J, AND RELATIVE HUMIDITY K.
UNITS			METERS	METERS	NONE, METERS				JOULES/M ²			TYPE 1 SMK ROUNDS
COMMON BLOCK	(LOCAL)	HEADNG	RSPTIM	(LOCAL)	RNGLOS	SYMBOL	L0GFLG	LOGFLG	PEDESC F.P.	г. О.	STITLE	SMOKED
TYPE							LOGICAL	LOGICAL		LOGICAL		
VARIABLE	RSPDAT(49)	RSPLDL(3,3)	RUMC	SEGLNG	SEGLOS(11,11)	SEP(5)	SEQNML	SHRTEC	SKSEN	SLCOM3	SLVERS	SMK2(3,3,2)

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DEFINITION	SAME AS SMK2 EXCEPT FOR TYPE 2 SMOKE ROUND.	SPCL(I) IS TRUE IF A SPECIAL OPTION IS IN EFFECT FOR KEYWORD I; FALSE IF SPECIAL OPTION NOT IN EFFECT.	TIME BETWEEN SUCCESSIVE ROUNDS FIRED ON A SINGLE REPLICATION.	CRITICAL TIME. LENGTH OF TIME INTERVAL AT TERMINAL PHASE OF TRAJECTORY DURING WHICH COPPERHEAD SEEKER MUST BE TRACKING A SPOT DESIGNATED ON (OR NEAR) THE TARGET.	FACTOR USED FOR INTERPOLATING WITH RESPECT TO RANGE IN PROBABILITY OF ENGAGEMENT TABLES WHEN IMUTS=2.	WEIGHTING FACTOR USED FOR INTERPOLATING WITH RESPECT TO RANGE IN TARGET POSTURE DISTRIBUTION TABLE.	WEIGHTING FACTOR USED FOR INTERPOLATING WITH RESPECT TO RANGE IN "TRUE TARGET FACTOR" TABLE.	WEIGHT FACTOR APPLIED FOR SHORTER RANGE WHEN INTERPOLATING WITH RESPECT TO RANGE IN PROBABILITY OF ENGAGEMENT TABLES WITH IMUTS=1.	WEIGHT FACTOR APPLIED FOR LONGER RANGE WHEN INTERPOLATING WHEN RESPECT TO RANGE IN PROBABILITY OF ENGAGEMENT TABLES WITH IMUTS=1.	ANGLE BETWEEN FOOTPRINT CENTROID-TO-GUN LINE AND TARGET DIRECTION OF TRAVEL.	ALPHANUMERIC DISPLAY OF TIME AT WHICH PROGRAM WAS RUN (OBTAINED FROM COMPUTER'S INTERNAL CLOCK).	CURRENT TIME IN SECONDS SINCE TARGET UNMASKED FROM TERRAIN.	TIME AT WHICH ROUND CURRENTLY BEING CONSIDERED WILL ARRIVE (IMPACT).	TIME AT WHICH FIRST ROUND OF THIS REPLICATION WILL ARRIVE (IMPACT).
UNITS	TYPE 2 SMK ROUNDS		SECONDS	SECONDS						DEGREES		SECONDS	SECONDS	SECONDS
COMMON BLOCK	SMOKED	LOGFLG	TIME	RANDOC	(LOCAL)	(LOCAL)	(LOCAL)	(L0CAL)	(LOCAL)	PEDESC (F.P.)	RUNDAT	TIME	TIME	TIME
TYPE		L0GICAL												
VARIABLE	SMK5(3,3,2)	SPCL(70)	TBR	TCRIT	TF	TFRAC	TFRAC1	TF1	1F2	ТGТНD	MIL	TIMNOM	TIMRA	TIMRAI

VARIABLE	TYPE	COMMONBLOCK	UNITS	DEFINITION
TMEAN(2,2)		RSPTIM	SECONDS	TMEAN(I,J) IS THE MEAN TIME REQUIRED TO ENTER COPPERHEAD FIRE MISSION REQUEST IN DIGITAL MESSAGE DEVICE FOR CONDITION I, J. (I=1 INDICATES DAY, I=2 INDICATES NIGHT, J=1 INDICATES PRE-PLANNED TARGET, J=2 INDICATES TARGET OF OPPORTUNITY).
TMPLBL(8)		DISPLY		ALPHANUMERIC CONSTANTS USED TO LABEL OUTPUT HEADINGS WHEN TEMPORARY OR OVERRIDE OPTION IS USED.
T0F		TIME	SECONDS	TIME OF FLIGHT FOR COPPERHEAD ROUND (TIME FROM FIRING UNTIL IMPACT).
TOFARY(16)		FLTTIM	SECONDS	TOFARY(I) IS THE TIME OF FLIGHT OF COPPERHEAD ROUND (USING PREFERRED ELEVATION AND CHARGE) FOR GUN-TO-TARGET RANGE OF I KILOMETERS.
TR		(LOCAL)	SECONDS	NOMINAL DESIGNATOR-FDC-BATTERY RESPONSE TIME.
TRARRY(3,2)		RSPTIM	SECONDS	TEARRY(I,J) IS THE NOMINAL DESIGNATOR-FDC-BATTERY RESPONSE TIME FOR MISSION TYPE I AND COMMUNICATION TYPE J. (I=1 INDICATES PRE-PLANNED TARGET, I=2 INDICATES TARGET OF OPPORTUNITY, I=3 INDICATES PRIORITY PRE-PLANNED TARGET, J=1 INDICATES DIGITAL COMMUNICATION, J=2 INDICATES VOICE COMMUNICATION).
TRBAR		RSPTIM	SECONDS	NOMINAL DESIGNATOR-FDC-BATTERY RESPONE TIME PLUS TIME OF FLIGHT.
TRBAR1		(LOCAL)	SECONDS	SAME AS TRBAR.
TSIGMA(2,2)		RSPTIM	SECONDS	TSIGMA(I,J) IS THE STANDARD DEVIATION OF THE DISTRIBUTION OF TIME REQUIRED TO ENTER COPPERHEAD FIRE MISSION REQUEST IN DIGITAL MESSAGE DEVICE FOR CONDITION I,J. (I,J HAVE SAME MEANING AS FOR THE VARIABLE TMEAN).
TTF(3,20,2)		HIT		TTF(1,J,K) IS THE PROBABILITY COPPERHEAD HITS THE TARGET GIVEN SEEKER ENGAGEMENT WITH DESIGNATOR TYPE I, RANGE J, AND TARGET POSTURE K. (I=1,2,3 INDICATE DESIGNATOR TYPES 1,2,3 RESPECTIVELY; J INDICATES JTH RANGE OF RNGTIF ARRAY; K=1 INDICATES FULLY EXPOSED TARGET, K=2 INDICATES HULL DEFILADE TARGET).
TVEL		TARGET	METERS/ SECONDS	TARGET SPEED.

VARIABLE	TYPE	COMMON BLOCK	UNITS	DEFINITION
E		(LOCAL)	SECONDS	FIRST TIME DELAY COMPONENT OF DELTAT. (ACCOUNTS FOR MULTIPLE VEHICLES AND MULTIPLE ROUNDS). ALSO, NOMINAL RESPONE TIME VALUE FOR PRINTING IN COMMENT.
12		(L0CAL)	SECONDS	SECOND TIME DELAY COMPONENT OF DELTAT. (ACCOUNTS FOR ACTUAL RESPONE TIME AND DETECTION TIME VERSUS NOMINAL RESPONSE TIME).
13		(LOCAL)	SECONDS, M/S	THIRD TIME DELAY COMPONENT OF DELTAT. (ACCOUNTS FOR POSITIONING OF FOOTPRINT WHEN RUMC IS PLAYED). ALSO, TARGET SPEED VALUE FOR PRINTING IN COMMENT.
14		(LOCAL)	ΜX	GUN-TO-TARGET RANGE VALUE FOR PRINTING IN COMMENT.
T5		(LOCAL)		TARGET REFLECTIVITY VALUE FOR PRINTING IN COMMENT.
T6		(LOCAL)	DEGREES	ANGLE T VALUE FOR PRINTING IN COMMENT.
77		(LOCAL)	METERS	DEFLECTION BIAS (POINT OF CLOSEST APPROACH TO FOOTPRINT CENTROID) VALUE FOR PRINTING IN COMMENT.
18		(LOCAL)	DEGREES	TARGET HEADING VALUE FOR PRINTING IN COMMENT.
19		(LOCAL)	JOULES/M ²	SEEKER SENSITIVITY VALUE FOR PRINTING IN COMMENT.
U(70)		UVALUE		U(I) IS A VALUE ASSOCIATED WITH KEYWORD I AND USED IN THE CURRENT CASE (EQUIVALENT TO UVALUE).
UDT		UVALUE		NO LONGER USED.
UIDIGT		UVALUE		UIDIGT=1.0 INDICATES DIGITAL DESIGNATOR-FDC COMMUNICATIONS; UIDIGT=2 INDICATES VOICE DESIGNATOR-FDC COMMUNICATIONS.
NIDN		UVALUE		UIDN=1 INDICATES DAY; UIDN=2 INDICATES NIGHT.
UMC		UVALUE		USED MISSION CODE. UMC=1,2,3 MEAN RESPECTIVELY PRE-PLANNED TARGET.
UPRT		UVALUE	SECONDS	USED PARAMETERIZED RESPONSE TIME.
URAN31		FUNCTION VALUE		URAN31 IS THE UNIFORM (PSEUDO-) RANDOM NUMBER GENERATOR USED IN THIS PROGRAM.
USERC	LOGICAL	F. P.		USERC=TRUE INDICATES A USER'S COMMENT; USERC=FALSE INDICATES A PROGRAM GENERATED COMMENT.

VARIABLE	TYPE	COMMON BLOCK	UNITS	DEFINITION
USMK(2)		UVALUE		USMK(1) IS THE NUMBER OF TYPE 1 SMOKE ROUNDS USED. USMK(2) IS THE NUMBER OF TYPE 2 SMOKE ROUNDS USED.
UVALUE(70)				EQUIVALENT TO U ARRAY.
VEL		Б.Р.	METERS/ SECONDS	TARGET SPEED.
VELTBL(2,2)		RNGLOS	METERS/ SECONDS	VELTBL(I,J) IS TARGET SPEED IN CONDITIONS I,J. (I=1 FOR DAY, I=2 FOR NIGHT, J=1 FOR SUMMER, J=2 FOR WINTER).
VERDAT(2)		STITLE		DATE (ALPHANUMERIC CONSTANT) OF LAST CHANGE TO CURRENT PROGRAM.
VIS(11)		WEATHR	Ж	VIS(I) IS THE ITH METEOROLOGICAL VISIBILITY RANGE LIMIT VALUE USED IN THE WEATHER DATA.
VISLIM		RANGE	Σ	THE METEOROLOGICAL VISIBILITY RANGE LIMIT VALUE FOR THE CURRENT REPLICATION.
VSMK		(LOCAL)	Ψ	LENGTH OF FRONT THAT CAN BE SMOKED WITH GIVEN NUMBER OF ROUNDS AND GIVEN WEATHER CONDITIONS. INTERMEDIATE VARIABLE IN CALCULATION OF PSMKKL.
W(6,11,2)		WEATHR		W(I,J,K) IS THE PROBABILITY (GIVEN A CLOUD CEILING) OF HAVING WEATHER WITH CLOUD CEILING ALTITUDE I, METEOROLOGICAL VISIBILITY RANGE LIMIT J, AND CLOUD FREE LOS CONDITION K (K=1 INDICATES CLOUD FREE LOS; K=2 INDICATES NO CLOUD FREE LOS).
WCFSUM(2)		WEATHR		SCFSUM(I) IS THE SUM OF ELEMENTS PRGCFL(1,I) THROUGH PRGCFL (NVL,I). (USED TO NORMALIZE RANDOM NUMBERS BEFORE SAMPLING FROM PRGCFL ARRAY).
WCODE		RECNAM		RECORD NAME KEY FOR WEATHER DATA RECORD ON WORD ADDRESSABLE MASS STORAGE FILE (TAPE 11).
WDATA(193)		(LOCAL)		ARRAY TO WHICH THE ELEMENTS OF THE WEATHER DATA BLOCK ARE EQUIVALENCED.
WK(6)		LOCAL		WORKING AREA ARRAY USED BY IMSL ROUTINE GGAMA.
WNDSPD(3,3)		WEATHR		WNDSPD(I,J) IS THE PROBABILITY OF HAVING JTH WINDSPEED GIVEN PASQUILL ATMOSPHERIC STABILITY CATEGORY 2*I OR 2*I-1.

DEFINITION	WSUM(I) IS THE SUM OF ELEMENTS W(1,1,1) THROUGH W(6,11,1). (USED TO NORMALIZE RANDOM NUMBERS BEFORE SAMPLING FROM W ARRAY).	USED AS INTERMEDIATE VARIABLE FOR CALLING FPRCNT.	PERCENTAGE VALUE SENT TO FPRCNT FUNCTION FOR FORMATTING.	XMTTIM(I,J) IS THE TIME REQUIRED TO TRANSMIT THE REQUEST FOR COPPERHEAD FIRE FROM DESIGNATOR OPERATOR TO FDC USING COMMUNICATION MODE I FOR A MISSION TYPE J. (I=1 FOR DIGITAL COMMUNICATION, I=2 FOR VOICE; J=1 FOR PRE-PLANNED TARGET, J=2 FOR TARGET OF OPPORTUNITY).	XMVADF(I) IS THE TIME REQUIRED TO TRANSMIT REQUEST FOR COPPERHEAD FIRE FROM DESIGNATOR OPERATOR TO FDC VIA VOICE AFTER TRYING DIGITAL (AND FAILING DIGITAL) FOR MISSION TYPE I. (I=1 FOR PRE-PLANNED TARGET, I=2 FOR TARGET OF OPPORTUNITY.)	NUMBER OF CURRENTLY UNKILLED VEHICLES IN TARGET.	NAME OF VALUES OUTPUT AFTER SPECIAL FORMATTING.	RANDOM SAMPLE VALUE RETURNED BY SUBROUTINE SMPLCD.	XVALUE(I,J,1) IS THE ITH ALLOWABLE VALUE FOR THE JTH PARA- METER USED TO CONSTRUCT (OR DECIPHER) THE PEDATA RECORD NAME. XVALUE(I,J,2) IS THE CODE NUMBER CORRESPONDING TO XVALUE (I,J,1). (NOTE THAT NOT ALL POSSIBLE I,J COMBINATIONS NEED CORRESPOND TO VALUES ACTUALLY ALLOWED IN CURRENT CASES.)	ALPHANUMERIC ABBREVIATION FOR NAME OF MONTH WHOSE WEATHER DATA IS BEING USED.	INTERMEDIATE VARIABLE NAME USED IN CALL TO FPRCNT.	REFORMATTED PERCENTAGE VALUES.	ALPHANUMERIC TIME OF DAY VALUE FOR WEATHER DATA.	REFORMATTED PERCENTAGE VALUES.
UNITS				SECONDS	SECONDS									
COMMON BLOCK	WEATHR	(LOCAL)	(F.P.)	RSPTIM	RSPTIM	(LOCAL)	(LOCAL)	(F.P.)	XVALUE	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)
TYPE														
VARIABLE	WSUM(2)	×	XIN	XMTTIM(2,2)	XMVADF(2)	XNX	XOUT	XSMPL	XVALUE(8,9,2)	XWTHR	>	YOUT	TWTHR	ZOUT

CHAPTER 13

13. CONVERSION TO OTHER COMPUTERS

The COPE model and its preprocessors were written for use on the US Army Ballistic Research Laboratories Control Data Corporation CYBER 76 (CDC 7600) computer. These programs use some of the features that are peculiar to CDC machines. This chapter points out some of the changes to COPE and its preprocessors that will be required to convert them to run on other machines.

13.1 Conversion To Other CDC Computers.

COPE and its preprocessors have been run on other CDC machines (a CDC 6600 at Aberdeen Proving Ground and a CDC 6400 and a CDC 6500 at FT Leavenworth, KS).

Two changes were required. The first was to change the Hollerith string delimiters from '(single quote) to whatever the host machine uses to delimit Hollerith strings (" double quote on the FT Leavenworth machine, \neq on machines using CDC's standard, * at some other installations). This includes strings on STOP statements.

The second change was to define the cotangent function in PAM. The BRL CDC machines have the cotangent (COT) function as a library function; some other machines do not. This can be easily fixed by defining COT(X) = 1./TAN(X) as an in-line or statement function in PAM. Of course an alternate fix is to replace each occurrence of COT(X) by (1./TAN(X)).

Once these changes were made, the COPE program and its preprocessors ran without any trouble on the other CDC machines.

13.2 Conversion To Non-CDC Computers.

The author cannot anticipate every problem the user may encounter in converting COPE and its preprocessors to run on other machines; however, there are certain changes that will have to be made and of which the author is aware. The only machine (other than the CDC machines) that the author uses to any significant extent is the UNIVAC 1108, so most of the comments in this section deal with changes the author knows will have to be made to get the programs working on the UNIVAC machines.

13.2.1 Hollerith Delimiters and STOP's. The first change that may be required is to change the Hollerith string delimiters from ' to whatever is used on the host machine.

The CDC machines allow a STOP statement with a message (the message is in Hollerith string delimiters itself) which is printed when that STOP is encountered. Other machines may allow only a number with the stop, only a shorter message (CDC allows up to 70 characters; UNIVAC allows 6 characters), or nothing at all. So depending on the STOP

messages allowed, all of the STOP statements in COPE and its preprocessors may require changes.

13.2.2 A FORMATS and Alphanumeric Arrays. The CDC machines use a 60 bit word and a six bit character code so that each word holds 10 characters. Hence, most of the alphanumeric reads, writes, encodes, and decodes use AlO format and most data statements use 10H format to set alphanumeric values.

For machines that use shorter words or 8 bit character codes, the number of characters per word will probably be fewer. This means that the AlO formats in COPE and its preprocessors (and, indeed, all An formats where n> number of characters per word on the host machine) must be changed. A similar remark applies to all 10H (or nH with n as above) formats in data statements. Reducing these formats to the limits of the host machine will sometimes require that arrays containing the alphanumeric data be redimensioned. For example, the B array in subroutine INPUT is currently dimensioned B(8,10); if used on the UNIVAC 1108 which has 6 characters per word, it would have to be redimensioned B(14,10) so that each row could still contain a full card image (80 characters).

13.2.3 Word Addressable Mass Storage Files. The CDC system subroutines to open, read from, write to, and close a word addressable mass storage file are respectively OPENMS, READMS, WRITMS, and CLOSMS. The array INDEX11, the system subroutine SYSTEMC, and the user routines NOREC and NOREC2 are also connected with COPE's use of word addressable files.

The most convenient way to adapt COPE's handling of these files to the host machine is probably to write subroutines OPENMS, READMS, WRITMS, and CLOSMS that use the host machines equivalent file type and commands, and which perform the same operations as on CDC.

In the specific case of the UNIVAC, for example, OPENMS would be a subroutine which first does a DEFINE FILE, then reads from the direct access file (using UNIVAC terminology -- this is equivalent to the CDC word addressable file) the current values of the INDX11 array. Subroutine READMS would search the INDX11 array for the desired record name and then when the name was found and the corresponding address v looked up, it would do a READ (11'v); if the record name were not found, NOREC would be called (or NOREC2 in PREPMS). Subroutine WRITMS would add a record name and address to INDX11 (or perhaps just modify the addresses if the record name were already present) and the do a WRITE (11'v). CLOSMS would do a WRITE (11'v) of INDX11 to TAPE11.

Non-CDC machines may also require redimensioning of INDX11 to allow record names to take up two (or more) words of characters. Also additional bookkeeping of record addresses may be required in PREPMS.

The calls to SYSTEMC and the defining of IRAY can be dispensed with if error prints are added that occur when attempting to read a non-existent record.

13.2.4 ENCODE and DECODE. Although most computers with FORTRAN IV compilers have ENCODE and DECODE statement's, there are some that may not and there are others that differ from CDC's.

If the host machine does not have ENCODE and DECODE statements, it would probably be worthwhile to write subroutines that perform the functions of ENCODE and DECODE and then replace all ENCODES and DECODES in COPE with calls to those subroutines.

If the host machine has ENCODE and DECODE a check should be made to see that they take the same arguments in the same order as the CDC ENCODE and DECODE statements and, if not, the necessary changes should be made.

- 13.2.5 DATE and TIME. CDC has two subroutines DATE and TIME that respectively give an 8 character date and a 9 character time. These are only called to obtain date and time values to be printed on the title page of the output. If the user's computer does not have equivalent subroutines, the calls to DATE and TIME may be deleted.
- 13.2.6 STRACE. The subroutine STRACE causes a printing of traceback information from the current subroutine back to the main program. This information gives the subroutine and line from which STRACE was called, the subroutine and line from which that subroutine was called, and so on back to the main program.

STRACE is available on both CDC and UNIVAC but it may not exist in some FORTRAN implementations (or it may have a different name). In either case, the user will need to check this point.

13.2.7 EOF. The CDC machine has a function called EOF. The value of $\overline{\text{EOF}}$ (IUNIT) is zero if the end of file has not been encountered on I/O unit IUNIT. After a READ, a test of EOF will yield a non-zero value if the end-of-file on that I/O unit has been encountered.

The CDC statements:

READ (IUNIT, 100) iolist
IF (EOF(IUNIT).NE.O.O) GO TO 99

are equivalent to:

READ (IUNIT, 100, END = 99) iolist

on most other machines.

13.2.8 COTANGENT. The PAM program uses the cotangent function (COT). If this is not a library function on the user's computer, then it should either be defined as a function (a statement function or external function) or else each occurrence of COT(X) should be replaced by (1./TAN(X)).

<u>13.2.9 Im.n FORMAT</u>. The CDC FORTRAN includes an Im.n format which specifies that an integer is to be written right justified in a field m characters wide with a minimum of n characters printed (m \geq n). This means that leading zeros are generated when the output value requires fewer than n digits. For example, if an integer variable with value 23 were to be written under I5.4 format, the result would be: b0023. Here b represents a blank so we have a field width of m=5 with n=4 characters printed even though 2 would have sufficed.

The Im.n is a standard format in FORTRAN 77, but since COPE is written in FORTRAN IV that may be of no help to the user whose FORTRAN IV compiler does not include it. On some machines a similar format (such as the UNIVAC Jn format) may be substituted; on other machines the user may have to simulate this format by using one of several different formats depending on the number of digits required to write the integer value.

13.3 GGAMA Function (IMSL).

The main COPE program uses the International Mathematical and Statistical Library (IMSL) function GGAMA. It is called from function GAMMA which is in turn called from GETTIM (it is used when the third method of playing response time is used).

If the IMSL is available on the user's computer, then it should be made available when COPE is loaded and run.

If the IMSL is not available to the user, then a function GGAMA should be written by the user or obtained from another library. It should take a random number seed IRN, an alpha parameter value (ALPHA), and return a gamma distributed random deviate R (with α = ALPHA and β = 1). The arguments IN and WK are arguments used by the IMSL routine and may or may not be used by the user's GGAMA.

CHAPTER 14

14. PREPMS PREPROCESSOR PROGRAM

14.1 General Remarks

The PREPMS preprocessor program performs three functions:

- (1) to create or modify records on the word addressable data base file (TAPE 11) by reading input cards (or card images) and writing their contents (in appropriate format and order) to TAPE 11.
- (2) to generate and print a list of the names of the current records on TAPE 11, and
- (3) to generate and print a list of the PE data records currently on TAPE II along with their respective parameter values (see section 5.4 for the relation of 9 parameters to PE data record names).

Because the PREPMS program is quite straightforward in design and shares many subroutines with COPE, it is not documented as thoroughly as the main COPE program; however, this chapter gives enough information to set up the input, understand the output, and generally understand what the program does.

A re-reading of Chapter 5 may be helpful in understanding what follows.

14.2 PREPMS Program Design.

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The PREPMS program consists of seven subprograms: the main program PREPMS, the block data subprogram BDATA2, the subroutines NOREC2, PENAME. and SEPRC2, and the functions IDCHAR and NUMRIC.

The subprograms PENAME, IDCHAR, and NUMRIC are identical to the subprograms of the same name in COPE. BDATA2 is merely a subset of BDATA1 of COPE; that is, it contains data statements that fill in the three common blocks LOGFLG, SYMBOL, and XVALUE as does BDATA1, but it does not fill in any of the other common blocks of BDATA1 as they are not needed by PREPMS.

The subroutine SEPRC2 is nearly identical to SEPREC of COPE. The only difference is that the message about sequence numbers in columns 73-78 of the input cards is written directly to OUTPUT instead of encoded and written via a call to COMMNT.

The subroutine NOREC2 is called (as a result of using CDC's SYSTEMC feature) whenever the program attempts to read a record named OPTNNUMS from TAPE 11 but does not find such a record. This should happen only when PREPMS is creating a new TAPE 11; when PREPMS is modifying an

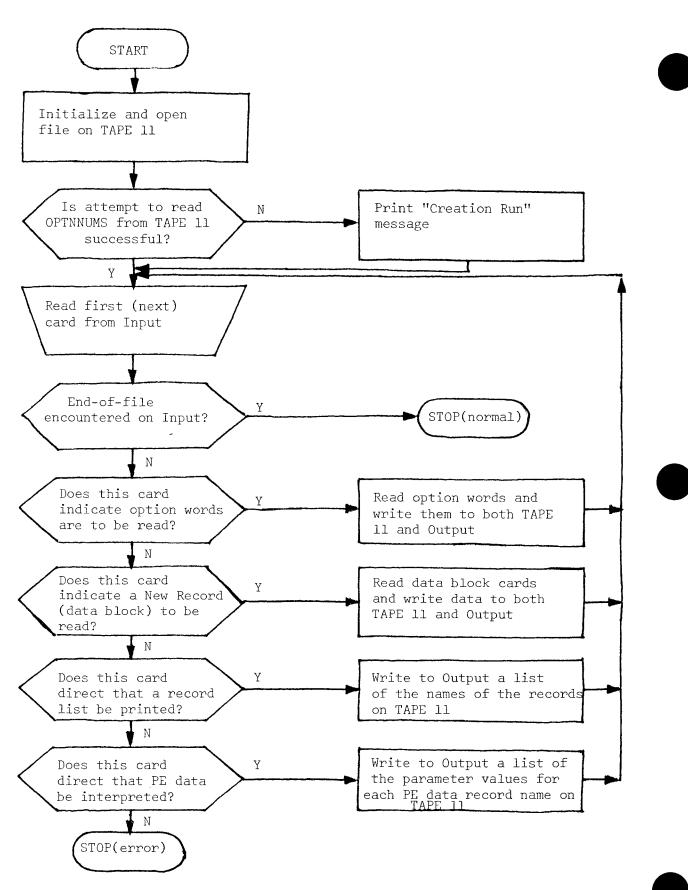


FIGURE 14-1 Logic Flow of PREPMS

existing TAPEII, there will already be an OPTNNUMS record on TAPEII. When no such record is found, NOREC2 is called; it then prints a message saying that the current job is a creation run and allows the program to continue.

The main program PREPMS is different from anything in COPE. Its main logic flow is shown in Figure 14-1. It begins by initializing (via DATA statements), calling SYSTEMC to set an error recovery procedure, and opening the file TAPEll. If it successfully reads the record named OPTNNUMS, it continues; if not, NOREC2 is called, a message is printed, and execution resumes. Next it attempts to read a card; if successful, the program continues; if unsuccessful, it has hit the end of file and a stop with normal termination message is issued.

The main program examines the card just read to determine what action to take next. Five possibilities exist:

- (1) The card indicates a set of option words follows. In this case, the option words are read, printed on OUTPUT and written to TAPE 11.
- (2) The card indicates a new record is to be read. In this case, the data for the new data block record is read, printed on OUTPUT, and written to TAPEII.
- (3) The card indicates a list of the names of the records currently on TAPEll is desired. In this case, such a list is generated and printed on OUTPUT.
- (4) The card indicates PE data record names are to be interpreted. In this case, the names of the PE data records currently on TAPEll are examined and the corresponding parameter values are determined. A list is then printed giving each PE data record's name and the corresponding parameter values.
- (5) None of the above in which case a stop with error message occurs.

Note: The terms INPUT and OUTPUT refer respectively to the files TAPE5 and $\overline{\text{TAPE6}}$ which correspond to I/o units 5 and 6. TAPE11 corresponds to I/o unit 11 and is another name for the word addressable data base file. Note that OUTPUT (or TAPE6) normally corresponds to a line printer and INPUT (or TAPE5) corresponds to either a punched card reader or a mass storage file of card images.

14.3 Glossary of PREPMS Variables.

The majority of the PREPMS variables have the same meaning as their namesakes in the COPE program. Therefore, the glossary in this section gives definitions only for those variables different from the main COPE model.

GLOSSARY OF PREPMS VARIABLES

VARIABLES	TYPE	COMMON BLOCK	UNITS	DEFINITION
CLABEL	REAL	(LOCAL)		THE RECORD NAME OF THE OPTION WORD RECORD JUST READ. NORMALLY THIS WILL BE THE ABBREVIATED FORM OF THE KEYWORD TO WHICH THE OPTION WORDS BELONG.
ICASE	INTEGER	(LOCAL)		THE TYPE NUMBER OF THE DATA BLOCK RECORD JUST READ. ICASE = 1 FOR WEATHER DATA, 2 FOR ACQUISITION DATA, 3 FOR RESPONSE TIME DATA, 4 FOR DIRECT FIRE SUPPRESSION DATA, 5 FOR RANDOM OCCURRENCE DATA, 6 FOR PEDATA, 7 FOR POSTURE DISTRIBUTION DATA, 8 FOR INVAR- IANT DATA, AND 9 FOR SADARM DATA (9 IS NOT USED IN RUNNING PREPMS FOR COPE).
ILIST(2000)	INTEGER	(LOCAL)		ILIST (21-1) IS THE NAME OF THE ITH RECORD ON TAPE 11 ILIST (21) IS A NUMBER (PRINTED IN OCTAL) GIVING THE LENGTH AND ADDRESS ON DISK (PACKED) OF THE ITH RECORD ON TAPE 11.
IOUT	INTEGER	(LOCAL)		IOUT IS A COUNTER USED TO RECORD THE NUMBER OF ILIST ENTRIES TO BE PRINTED.
IPECOD	INTEGER	(LOCAL)		IPECOD IS THE NAME OF THE PE DATA RECORD CURRENTLY BEING EXAMINED TO DETERMINE PARAMETER VALUES.
IRLT1, IRLT2,, IRLT9	INTEGER	(L0CAL)	WORDS	IRLTI IS THE RECORD LENGTH OF TYPE 1 DATA BLOCK RECORDS (WEATHER DATA); IRLT2 IS THE RECORD LENGTH OF TYPE 2 DATA BLOCK RECORDS (ACQUISITION DATA);; IRLT9 IS THE RECORD LENGTH OF TYPE 9 DATA BLOCK RECORDS (SADARM DATA).
IUNIT	INTEGER	(LOCAL)		I/O UNIT FROM WHICH PE DATA IS TO BE READ (MUST BE EITHER 4 OR 5).
12	INTEGER	(LOCAL)		DESIGNATOR TYPE NUMBER (1 = GLLD, 2 = MULE, 3 = LTD).
NOP TNM(70)	INTEGER	(LOCAL)		NOPTNM(I) IS THE NUMBER OF OPTION WORD CHARACTER STRINGS CURRENTLY AVAILABLE FOR USE WITH KEYWORD NUMBER I.
NOPT1	INTEGER	(LOCAL)		NUMBER OF THE KEYWORD CORRESPONDING TO THE SET OF OPTION WORDS JUST READ.
NREAD	INTEGER	(LOCAL)		NUMBER OF OPTION WORD CHARACTER STRINGS TO BE READ IN THIS SET OF OPTION WORDS.

GLOSSARY OF PREPMS VARIABLES - CONTINUED

DEFINITION	TEMPORARY NAME FOR THE VALUE TO BE LOADED INTO CHARA (1,1J). IT IS THE NUMBER OF THE OPTION FOR ITS OPTION WORD POSITION (GIVEN BY CHARA (2,1J) OR XLEV) TO WHICH THE CHARACTER STRING TO FOLLOW BELONGS.	PECHK IS THE FIRST FOUR CHARACTERS (LEFT JUSTIFIED WITH BLANK FILL) OF THE NAME OF THE RECORD ON TAPEIL CURRENTLY BEING EXAMINED TO DETERMINE WHETHER IT IS A PE DATA RECORD.	NAME OF CURRENT DATA BLOCK RECORD.	THESE CORRESPOND RESPECTIVELY TO THE FIRST, THIRD, FOURTH,, NINTH ARGUMENTS OF SUBROUTINE PENAME (AND ITS ENTRY PEIDNT) TI IS NOMINAL RESPONSE TIME, T3 IS TARGET VELOCITY, T4 IS GUN-TARGET RANGE, T5 IS TARGET REFLECTIVITY, T6 IS ANGLE T, T7 IS DEFLECTION BIAS, T8 IS TARGET HEADING, AND T9 IS SEEKER SENSITIVITY.	TEMPORARY NAME FOR VALUE TO BE LOADED INTO NREAD (DEFINED ABOVE).	XLEV IS TEMPORARY NAME FOR VALUE TO BE LOADED INTO CHARA(2,1J). IT IS THE OPTION WORD NUMBER FOR WHICH THE CHARACTER STRING TO FOLLOW IS A POSSIBLE CHOICE.	Y IS A TEMPORARY NAME FOR THE VALUE TO BE LOADED INTO NOPTI (DEFINED ABOVE).	TEMPORARY NAME FOR VALUE TO BE LOADED INTO ICASE (DEFINED ABOVE).
UNITS								
COMMON BLOCK	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)	(LOCAL)
TYPE	REAL	REAL	REAL	REAL	REAL	REAL	REAL	REAL
VARIABLES	0PT	РЕСНК	RLABEL	T1, T3, T4, T5, T6, T7, T8, T9	×	XLEV	>-	ZCASE

To find the definition of a variable in PREPMS, one should first look in the glossary of this section. Then, if the variable is not found, look in the glossary of COPE variables in Chapter 12.

Note that all variables in common block SADARB are used only with the SADARM variant of COPE (called SOPE) and are not defined herein. This remark also applies to the WPNDAT array.

14.4 PREPMS INPUTS.

The PREPMS inputs are divided into four types:

- (1) option word records
- (2) data block records
- (3) REPORT RECORD LIST directives, and
- (4) INTERPRET PEDATA directives.

The second type (data block records) is further divided into eight types of data blocks. The sections concerning data block record types (sections 14.4.2(1) through 14.4.2(8)) also give instructions for setting up data to be read by COPE using the TEMPORARY feature (see section 4.5).

Note that if two or more option word records are read corresponding to the same keyword (see section 14.4.1) then only the last one read will have any effect. Similarly, if two or more data block records are read under the same record name, only the last one read will be retained on TAPEII. This means that any modifications to either type 1 or type 2 input (as listed above) require that the entire desired record contents be read (not just the additions).

Also, note that inputs of the four types may be arranged in any order provided that the integrity of the multiple card (or card image) input types (types 1 and 2) is preserved. However, types 3 and 4 only have effect on the file (TAPEII) as it exists at the time they are encountered; hence, they are usually put at the end of the input.

 $\frac{14.4.1 \;\; \text{Option Word Records.}}{\text{of one card (or card image) of type 1 and NREAD cards of type 2 following the type 1 card.}}$

The general form of the type 1 card is:

OPTION WORDS, keyword, m, n

or

OPTWDS, keyword, m, n

where: keyword is replaced by the character string giving the abbreviated form of the keyword to which the option words are to apply;

 \underline{m} = NREAD, a positive integer giving the number of type 2 cards to be read for this option word; and

 \underline{n} = NOPT1, a positive integer giving the keyword number (see section $5.\overline{3.9}$) of the keyword to which the option words are to apply.

The general form of each type 2 card is:

mm, nn, Option word character string

where: $\underline{mm} = NOPTWC$, the number of the option word choice to which the character string belongs (NOPTWC is a positive integer);

 \underline{nn} = NOPTW, a positive integer equal to one plus the number of the option word for which the character string is an allowed choice; and

Option word character string is the actual character string allowed as a choice.

The subsequent use of option word character string in a COPE run as a choice for option word NOPTW-1 on a keyword input card for keyword number NOPTI causes option number NOPTWC to be activated for option word NOPTW-1. (See example in section 5.3.8; for a second example, see appendixes C and D.)

Note: While blanks may be freely inserted in COPE inputs (keywords and option words) with no effect (the single exception being blanks occurring within 10 spaces after a "\$" - see section 4.5.3), there should be no internal blanks in the character strings on type 2 cards.

Also, no more than 2 option word character strings applying to the same keyword are allowed to correspond to a given NOPTWC, NOPTW pair.

Finally, no more than 30 type 2 cards are allowed with any type 1 card.

14.4.2 Data Block Records. There are eight data block record types:

- (1) Weather data
- (2) Acquisition data
- (3) Response time data
- (4) Direct Fire Suppression data
- (5) Random Occurrence data
- (6) PE (probability of engagement data)
- (7) Target Posture Distribution data
- (8) Invariant data

The formatting of the input required for each of these types is presented in a separate subsection of this section.

Note that these eight data blocks correspond exactly to the eight data blocks that can be used with the TEMPORARY option in COPE. Furthermore, the formats used by COPE under the TEMPORARY option and by PREPMS are identical except for the first card (or card image) of each set. The sections that follow give the set-ups required for use with either program.

The first card (header card) in each case is free format: blanks may be freely inserted, fields are defined by separators (commas, for example). Subsequent cards of each data block type are formatted FORTRAN inputs and care must be taken to conform to the specified formats.

1. Weather Data Block Input.

When reading weather data into PREPMS for transfer onto TAPEII, the first card (which indicates a weather data record is to be input) must be of the form:

NEW RECORD, record name, 1

or

NEW REC, record name, 1

where record name is the name of the weather data record to be read. (See section 5.3.1 for the form of weather data record names).

When using the TEMPORARY option with COPE, the weather data is headed by a card of the form:

TEMPORARY, WEATHER or TEMPORARY, W

or

TEMP, WEATHER or TEMP, W

In either case (whether reading weather data in PREPMS or COPE), the remaining cards of the weather data are as follows:

WEATHER DATA CARD SET

Card No. 2

Variable name	UNITS	Format	columns	Description
NCC		15	1-5	Number of different cloud ceiling altitude values used with the curren weather data. (If NCC >6, then arra dimension changes are required).
IVL		15	6-10	Number of different visibility range limits used with the current weather data. (If NVL \$11, then array dimension changes and program modifications are usually required).
			14-9	

WEATHER DATA CARD SET

Card No. 3

Variable name	UNITS	Format	columns	Nescription
PRCLCG		F10.4	1-10	Probability that there is a cloud ceiling.
PRCFLS(1)		F10.4	11-20	Probability that there is a cloud free line-of-sight given that there is a cloud ceiling.
PRCFLS(2)		F10.4	21-30	Probability that there is a cloud free line-of-sight given that there is no cloud ceiling (i.e., scattered clouds only).
		L.		
		-	14-10	

WEATHER DATA _____CARD SET

Card No. 4ª

Variable name	UNITS	Format	columns	Description
PRGCFL(1,1) PRGCFL(2,1)		F10.4	1-10 11-21	PRGCFL(I,1) is the probability that the visibility range limit is equal to I kilometers given that there is a cloud ceiling and a cloud free line-of-sight.
1				Note: The visibility range limit is considered to be I kilometers if $(I-1/2)$ km < visibility range limit < $(\bar{I}+1/2)$ km.
PRGCFL(8,1)		F10.4	71-80	
			:	
		1.	14-11	

WEATHER DATA ____CARD SET

Card No. 45

Variable name	UNITS	Format	columns	Nescription
PRGCFL(9,1)		F10.4	1-10	PRGCFL(I,1) is described on previous page.
PRGCFL(11,1)		F10.4	21-30	
	_		14-12	

WEATHER DATA ___CARD SET

Card No. 5a

Variable name	UNITS	Format	columns	Nescription
PRGCFL(1,2)		F10.4	1-10	PRGCFL(I,2) is the probability that the visibility range limit is equal to I kilometers given that there is no cloud ceiling and that there is a cloud free line-of-sight. The note on card 4a applies.
PRGCFL(2,2)		F10.4	11-20	The note on card 4a applies.
ı				
PRGCFL(8,2)		F10.4	71-80	
	-			
			14-13	

WEATHER DATA CARD SET

Card No. 5b

Variable name	UNITS	Format	columns	Nescription
PRGCFL(9,2)		F10.4	1-10	PRGCFL(I,2) is described on previous page.
PRGCFL(11,2)		F10.4	21-30	
			14-14	

WEATHER DATA

__CARD SET

Card No. 6a

Variable name	UNITS	Format	columns	Nescription
W(1,1,1)		F10.4	1-10	W(I,J,I) is the probability of having the Ith cloud ceiling altitude
W(2,1,1)		F10.4.	11-20	and the Jth visibility range limit given that there is a cloud ceiling but no cloud free line-of-sight.
W(3,1,1)		F10.4	21-30	
W(4,1,1)		F10.4	31-40	
W(5,1,1)		F10.4	41-50	
W(6,1,1)		F10.4	51-60	
			1 1 4 4 5 1 1 1 1	
Ī		1	14-15	

WEATHER DATA ____CARD SET

Card No. 6b

Variable name	ZTINU	Format	columns	Nescription
W(1,2,1)		F10.4	1-10	W(I,J,1) is as defined on previous page.
W(2,2,1)		F10.4	11-20	
W(3,2,1)		F10.4	21-30	
W(4,2,1)		F10.4	31-40	
W(5,2,1)		F10.4	41-50	
W(6,2,1)		F10.4	51-60	
ļ			14-16	1

Cards 6c through 6k are similar to cards 6a and 6b except each successive card contains W(I,J,l) values for a higher value of J:

card "	6a 6b 6c	contains "	W(1,1,1) W(1,2,1) W(1,3,1)	through " "	W(6,1,1) W(6,2,1) W(6,3,1) W(6,4,1)
11	6d	II	W(1,4,1)	11	W(6,5,1)
11	6e	11	W(1,5,1)	11	
н	6f	н	W(1,6,1)		W(6,6,1)
11	6g	II	W(1,7,1)	11	W(6,/,I)
11	6ň	п	W(1,8,1)		W(6,8,1)
11	6i	н	W(1,9,1)	II	W(6,9,1)
H.	6.j	П	W(1,10,1)	П	W(6,10,1)
ıı	6k	II	W(1,11,1)	11	W(6,11,1)

Each of these cards contains six values, $\left\{W(1,J,1),\ W(2,J,1),\ W(3,J,1),\ W(4,J,1),\ W(5,J,1),\ and\ W(6,J,1)\right\}$, in 6F10.4 format (exactly as illustrated for cards 6a and 6b on the previous two pages).

WEATHER DATA

__CARD SET

Card No.7a

Variable name	UNITS	Format	columns	Description
W(1,1,2)		F10.4	1-10	W(I,J,2) is the probability of
W(2,1,2)		F10.4	11-20	having the Ith cloud ceiling altitud and the Jth visibility range limit given that there is no cloud ceiling and no cloud free line-of-sight.
W(3,1,2)		F10.4	21-30	
W(4,1,2)		F10.4	31-40	
W(5,1,2)		F10.4	41-50	
W(6,1,2)		F10.4	51-60	
				! !
			j 	
			! !	
		1	14-18	

WEATHER DATA CARD SET

Card No. ________

Variable name	UNITS	Format	columns	Nescription
W(1,2,2)		F10.4	1-10	W(I,J,2) is as defined on previous page.
W(2,2,2)		F10.4	11-20	page.
W(3,2,2)		F10.4	21-30	
W(4,2,2)		F10.4	31-40	
W(5,2,2)		F10.4	41-50	
W(6,2,2)		F10.4	51-60	
				!
				,
			!	
		-		
		1	14-19	ì

Cards 7c through 7k are similar to cards 7a and 7b except each successive card contains W(I,J,2) values for a higher value of J:

card	7a	contains	W(1,1,2)	through	W(6,1,2)
Н	7b	н	W(1,2,2)	11	W(6,2,2)
41	7c	н	W(1,3,2)	11	W(6,3,2)
н	7d	11	W(1,4,2)	u	W(6,4,2)
н	7e	п	W(1,5,2)	II	W(6,5,2)
11	7f	11	W(1,6,2)	н	W(6,6,2)
tt.	7q	41	W(1,7,2)	II	W(6,7,2)
н	7ň	п	W(1,8,2)	11	W(6,8,2)
и,	7i	п	W(1,9,2)	11	W(6,9,2)
П	7.j	н	W(1,10,2)	н	W(6,10,2)
н	7Ř	П	W(1,11,2)	11	W(6,11,2)

Each of these cards contains six values,

 $\left\{W(1,J,2), W(2,J,2), W(3,J,2), W(4,J,2), W(5,J,2), \text{ and } W(6,J,2)\right\}$

in 6F10.4 format (exactly as illustrated for cards 7a and 7b on the previous two pages).

WEATHER DATA CARD SE

____CARD SET Card No. 8a

Variable name	UNITS	Format	columns	Nescription
VISLIM(1)	km.	F10.4	1-10	VISLIM (I) is the Ith visibility
VISLIM (2)	km.	F10.4	11-20	range limit value. Any choice other than VISLIM(I) = I kilometers will require program
VISLIM (3)	km.	F10.4	21-30	changes to COPE.
4	1	,		
1	t	1		
1	1	t		
1		t		
VISLIM (8)	km.	F10.4	71-80	
VISEIN (O)	N.III.	.] , ' ' ' ' '		
			:	
			14-21	

WEATHER DATA _____CARD SET

Card No. 8b

Variable name	UNITS	Format	columns	Nescription
VISLIM (9)	km.	F10.4	1-10	VISLIM (I) is as described on previous page.
1	ļ !	'		
1	'			
1		ı		
VISLIM (11)	km.	F10.4	21-30	
				i
			7	
	ļ			
			14-22	

WEATHER DATA

CARD SET

Card No. 9

Variable name	UNITS	Format	co1 umns	Nescription
CLOUD (1)	meters	F10.4	1-10	CLOUD (I) is the Ith cloud ceiling altitude in meters used for the current set of weather data.
CLOUD (2)	meters	F10.4	11-20	Current Set of Weather Gasa.
CLOUD (3)	meters	F10.4	21-30	
CLOUD (4)	meters	F10.4	31-40	
CLOUD (5)	meters	F10.4	41-50	
CLOUD (6)	meters	F10.4	51-60	
			:	
		1	14-23	

WEATHER DATA CARD SET Card No. 10

Variable name	UNITS	Format	columns	nescription
PASQL (1)		F10.4	1-10	PASQL(I) is the probability of occurrence of the Ith Pasquill
PASQL (2)	:	F10.4	11-20	atmospheric stability category. (Category A corresponds to I=1, B to I=2, etc.)
PASQL (3)		F10.4	21-30	
PASQL (4)		F10.4	31-40	
PASQL (5)		F10.4	41-50	
PASQL (6)		F10.4	51-60	
			14-24	

WEATHER DATA CARD SET Card No. 11

Variable name	UNITS	Format	columns	Nescription
WNDSPD (1) WNDSPD (2) WNDSPD (3)		F10.4 F10.4 F10.4	1-10 11-20 21-30	WNDSPD (I) is the probability that the windspeed is in speed bracket I. (Speed bracket I=1 includes windspeeds from 0 to 5 knots, I=2 includes from 5 to 15 knots and I=3 includes 15 knots and over).
			14-25	

WEATHER DATA CARD SET

Card No. 12

Variable name	UNITS	Format	columns	Nescription
HUMID (1)		F10.4	1-10	HUMID (1) is the probability that the relative humidity is less than 65%;
HUMID (2)		F10.4	11-20	HUMID (1) is the probability that the relative humidity is less than 65%; HUMID (2) is the probability that the relative humidity is greater than (or equal to) 65%.
			, 1 2 1	
	-			
			14-26	

2. Acquisition Data Block Input.

When reading acquisition data into PREPMS for transfer onto TAPE11, the first card (which indicates an acquisition data record is to be read) must be of the form:

NEW RECORD, record name, 2

or

NEW REC, record name, 2

where record name is the name of the acquisition data record to be read (see section 5.3.2 for the form of acquisition data record names).

When using the TEMPORARY option with COPE, the acquisition data is headed by a card of the form:

TEMPORARY, ACQUISITION RANGE DISTRIBUTION

or

TEMPORARY, ACQRNGDIST

or

TEMP, ACQUISITION RANGE DISTRIBUTION

or

TEMP, ACQRNGDIST

In either case (whether reading acquisition data in PREPMS or COPE), the remaining cards of the acquisition data are as follows:

ACQUISITION DATA __CARD SET Card No. _ 2

Variable name	UNITS	Format	columns	Pescription
NRP		15	1-5	Number of range points used in the CRNGD array (Cumulative distribution of acquisition (unmasking) ranges.)
NPP		15	5-10	Number of points used within each range class to describe cumulative distribution of line-of-sight segment lengths.
NRNGCL		15	11-15	Number of range class boundary value to be used (equals one less than the number of range classes) Note: Zerc is always assumed to be the lower boundary of the shortest range class so it need not be explicitly entered as input nor counted as a boundary value for NRNGCL.
		-		

ACQUISITION DATA ____CARD SET

Card No. 3a

Variable name	UNITS	Format	columns	Nescription
CRNGD(1,1) CRNGD(2,1)		F10.4	1-10	CRNGD(I,1) is the probability that the designator-to-target range at time of target unmasking is less than or equal to the value in
anyan (a. t.)		F10. 4		CRNGD(I,2)
CRNGD(3,1)		F10.4	21-30	Note: CRNGD(1,1) = 0.0
1		1	1.	and CRNGD(NRP,1) = 1.0
1		/	/	must be satisfied. Also, the entries must increase as I increases.
CRNGD(8,1)		F10.4	71-80	
				Note: If NRP ≤ 8, only one card of this type will be needed; if NRP > 8, then a second card must continue with CRNGD(9,1) through CRNGD(NRP,1). NRP cannot exceed 11 with current dimensions.
			14-29	

ACQUISITION DATA CARD SET

Card No. 3b

Variable name	UNITS	Format	columns	Nescription
Variable name CRNGD(1,2) CRNGD(2,2) ! ! CRNGD(8,2)	UNITS meters meters ! ! meters	Format F10.4 F10.4	columns 1-10 11-21 / / / / / // // // // // // // // //	CRNGD(I,2) is the range value corresponding to the cumulative probability value in CRNGD(I,1). The values must increase as I increases. Note: If NRP \leq 8, only one card of this type will be needed; if NRP > 8, then a second card must continue with CRNGD(9,2) through CRNGD(NRP,2) NRP cannot exceed 11 with current dimensions.
	,		14-30	

ACQUISITION DATA CARD SET

Card No. 4a

Variable name	UNITS	Format	columns	Description
SEGLOS(1,1) SEGLOS(2,1)		F10.4 F10.4 / / / / / / / / / / / / / / / / / /	1-10	SEGLOS(I,1) is the probability that the length of a line-of-sight segment in range class K is less than or equal to SEGLOS(I, K+1) meters. Note: SEGLOS(1,1) = 0.0 SEGLOS(NPP,1) = 1.0 and SEGLOS(I,1)< SEGLOS(I+1,1) for I = 1,2, NPP-1.
SEGLOS(8,1)		F10.4	71-80	
				If NPP <8, only one card of this type will be needed; if NPP >8, then a secon card must continue with SEGLOS (9,1) through SEGLOS(NPP,1). NPP cannot excee ll with current dimensions.
			14-31	

ACQUISITION DATA

____CARD SET

Card No. 4b

Variable name	UNITS	Format	columns	Nescription
SEGLOS(1,2) SEGLOS(2,2) SEGLOS(2,3)	meters meters meters	F10.4 F10.4 F10.4 , , , , , , , , , , , , , , , , , ,		SEGLOS(I,2) is the line-of-sight segment length value corresponding to the cumulative probability value in SEGLOS(I,1) when the range from D.O. to target unmask falls in the first range class. Note: SEGLOS(I,2) < SEGLOS (I+1,2) for I = 1,2,, NPP-1. Note: If NPP <8, only one card of this type is needed; if NPP >8, then a second card must continue with SEGLOS(9,2) through SEGLOS(NPP,2). NPP cannot exceed ll with current dimensions.
			14-32	

The SEGLOS array is read from additional cards similar to 4b up to a maximum of 11 cards (or card pairs if NNP >8).

Each card (or card pair if NPP >8) has the following content:

card "" "" "" ""	4a 4b 4c 4d 4e 4f 4g 4h 4i 4j	contains " " " " " " " " "	SEGLOS(1,1) SEGLOS(1,2) SEGLOS(1,3) SEGLOS(1,4) SEGLOS(1,5) SEGLOS(1,6) SEGLOS(1,7) SEGLOS(1,7) SEGLOS(1,8) SEGLOS(1,9) SEGLOS(1,10)	through	SEGLOS(NPP,1) SEGLOS(NPP,2) SEGLOS(NPP,3) SEGLOS(NPP,4) SEGLOS(NPP,5) SEGLOS(NPP,6) SEGLOS(NPP,7) SEGLOS(NPP,8) SEGLOS(NPP,8) SEGLOS(NPP,9) SEGLOS(NPP,10)
11	4j 4k	"	SEGLOS(1,10) SEGLOS(1,11)	11	SEGLOS(NPP,11)

If NPP >8 then each card above is replaced by a card pair. In this case, the first card of each pair contains eight values and the second card contains NPP-8 values (each card is in 8F10.4 format). SEGLOS(1,J) through SEGLOS(NPP,J) contain (for J>2) the line-of-sight segment lengths in meters for range class J-l corresponding respectively to the cumulative probability values in SEGLOS(1,1) through SEGLOS(NPP,1). The total number of cards (or card pairs if NPP>8) will be NRNGCL + 1 (one for probabilities plus one for each range class). Hence, if NRNGCL = 10, all cards 3a through 3k will be used; but, if NRNGCL <10, then only the first NRNGCL + 1 cards (or card pairs if NPP >8) shown above will be used.

ACQUISITION DATA ____CARD SET Card No. ___5

Variable name	UNITS	Format	columns	nescription .
RNGCLB(1)	meters	F10.4	1-10.	RNGCLB(I) is the Ith non-zero
RNGCLB(2)	meters	F10.4	11-20	range class boundary. That is, range class I runs from
KNGCLD(2)	l lie cers	110.4		zero to RNGCLB(1) meters
i	,	1		and, for I > 1, range class I runs from RNGCLB(I-1)
1		,	1	meters to RNGCLB(I) meters.
1	1	1	/	(When the DO-to-target unmask range lies in range
				class I, then the (I + 1)st
RNGCLB(8)	meters	F10.4	71-80	row of the SEGLOS array is sampled to obtain LOS
				segment lengths.)
				Note that O <rngclb(1)< <rngclb(i)<="" td=""></rngclb(1)<>
	}			<rngclb(i+1)<<∞.< td=""></rngclb(i+1)<<∞.<>
			1	Also note that if NRNGCL <8,
				then only one card of this type
				is needed; but, if NRNGCL> 8, then a second card must continue
				with RNGCLB(9) through
				RNGCLB(NRNGCL). Finally, RNGCLB cannot exceed 10 with
				current dimensioning.
			į	!
			1	
		1	14-34	

ACQUISITION DATA ____CARD SET

Card No. <u>6a</u>

Variable name	UNITS	Format	columns	Nescription
VELTBL(1,1)	M/S	F10.4	1-10	VELTBL(I,J) gives the target velocity default value in the current terrain under
VELTBL(2,1)	M/S	F10.4	11-20	day/night condition I and weather condition J. I = 1 for day time 2 for nighttime
				J = 1 for "good" weather 2 for "bad" weather
				; ; ;
			\$; !	
			14-35	

ACQUISITION DATA CARD SET Card No. 6b

Variable name	UNITS	Format	columns	Nescription
VELTBL(1,2)	M/S	F10.4	1-10	(see previous page)
VELTBL(2,2)	M/S	F10.4	11-20	
		•		
,				
		1	14-36	

3. Response Time Data Block Input.

When reading response time data into PREPMS for transfer to TAPEII, the first card (which indicates that a response time data record is to be read) must be of the form:

NEW RECORD, record name, 3

or

NEW REC, record name, 3

where record name is the name of the response time record to be read (see section 5.3.3. for response time record names).

When using the TEMPORARY option with COPE, the response time data is headed by a card of the form:

TEMPORARY, RESPONSE TIME

or

TEMPORARY, RESPTIME

or

TEMP, RESPONSE TIME

or

TEMP, RESPTIME

Note: When the first method (section 2.2.9) of modeling delay times in COPPERHEAD mission communication and processing is played, in COPE, the response time distribution used is the one defined by data statements in BDATAl (namely, the FSRT array - see section 4.7.6).

Because this array is sampled to obtain response times, the values on cards 4, 5, and 6 of this card set are not used. However, cards must still be input (though they may be blank) so that the statements which read the later cards of this set will pick up the correct data.

The record name used with the data for the first method of playing response time must be RSPDATO123 unless one makes code changes in COPE to allow for others.

In any case (whether reading response time data in PREPMS or COPE), the remaining cards of the response time data are as follows:

RESPONSE TIME CARD SET Card No. 2

Variable name	UNITS	Format	columns	Nescription
NDT		15	1-5	Number of points to be entered in each row of DETTMA array. NDT ≤10 with current dimensions.
			1	
		E-1		
			: - -	
		+	14-38	

RESPONSE TIME ____CARD SET

Card No. 3a

Variable name	UNITS	Format	columns	Nescription
DETTMA (1,1)		F10.4	1-10 11-20	DETTMA (I,1) is the probability that the "detection" time is less than or equal to DETTMA(I,2) seconds.
1		1 1 1		Note: DETTMA (1,1) = 0.0 and DETTMA (I) < DETTMA (I +1)
DETTMA(8,1)		F10.4	71-80	Also note that if NDT < 8, only one card of this type is required; if NDT > 8, then a second card is required with DETTMA (9,1) through DETTMA (NDT,1).
		1	14-39	

RESPONSE TIME CARD SET

Card No. 3b

Variable name	UNITS	Format	columns	Description
DETTMA (2,1) DETTMA (2,2) DETTMA (8,2)	seconds seconds ! ! seconds	F10.4 F10.4 !	columns 1-10 11-20 1 1 71-80	DETTMA (I,2) is the "detection" time in seconds corresponding to DETTMA (I,1). Note: DETTMA (I) < DETTMA (I+1) Also, if NDT < 8 only one card is needed; if NDT > 8, then DETTMA (9,2) through DETTMA (NDT,2) continue on a second card.

RESPONSE TIME

___CARD SET

Variable name	2T INU	Format	columns	Nescription
BATRTM (1)	seconds	F10.4	1-10	BATRTM (I) is the response time at the battery for a Copperhead
BATRTM (2)	seconds	F10.4	11-20	mission of type I. I = l for preplanned targets
BATRTM (3)	seconds	F10.4	21-30	I = 2 for targets of opportunity
XMVADF (1)	seconds	F10.4	31-40	I = 3 for priority preplanned targe XMVADF (I) is the time required to transmit message via voice commo after failing to transmit via digital commo.
XMVADF (2)	seconds	F10.4	41-50	<pre>I = 1 for pre-planned targets (priority or not)</pre>
				I = 2 for targets of opportunity Note: The first way of modeling delatimes does not use the data on cards 4, 5, and 6; hence, they may be left blank. The second way of modeling deltimes does not use any RESPONSE TIME data block values, so no record is prepared corresponding to the PARAM option. Finally, the third delay time model uses all data in the data bloc See sections 2.2.9, 4.4.15 and 9.23 for further details on the three delay time models.
		1	14-41	

RESPONSE TIME CARD SET Card No. 5

BCSPTM (1,1)	seconds	i		
5	0000	F10.4	1-10	BCSPTM (I,J) is the battery com- puter system processing time for
BCSPTM (2,1)	seconds	F10.4	11-20	commo type I and mission type J.
BCSPTM (1,2)	seconds	F10.4	21-30	I·= l for digital commo I = 2 for voice commo
BCSPTM (2,2)	seconds	F10.4	31-40	J = 1 for pre-planned target (priority or not)
хмттім (1,1)	seconds	F10.4	41-50	J = 2 for target of opportunity XMTTIM (I,J) is the commo trans- mission time for commo type I and
XMTT1M (2,1)	11	F10.4	51-60	and mission type J where I and J are as for BCSPTM above.
XMTT1M (1,2)	n	F10.4	61-70	are as you seek with seek
XMTT1M (2,2)	H	F10.4	71-80	
			14-42	

RESPONSE TIME

___CARD SET

TMEAN (2,1) seconds F10.4 I1-20 message device in day/night condition I and TSIGMA (1,2) seconds F10.4 I1-20 message device in day/night condition I and TSIGMA (1,2) seconds F10.4 I1-20 II-20 message device in day/night condition I and TSIGMA (1,1) seconds F10.4 I1-20 III-20					
TMEAN (2,1) seconds F10.4 I1-20 message device in day/nig I and mission type J. I = 1 for day time I = 2 for night J = 1 for pre-planned to (priority or not) J = 2 for target of oppor TSIGMA (1,1) seconds F10.4 I1-50 TSIGMA (I,J) is the stand deviation of the distribution of Distribution Distributi	Variable name	UNITS	Format	columns	Nescription
TMEAN $(2,1)$ seconds F10.4 11-20 message device in day/night and mission type J. I = 1 for day time I = 2 for night J = 1 for pre-planned to (priority or not) J = 2 for target of opports TSIGMA $(1,1)$ seconds F10.4 41-50 TSIGMA $(1,1)$ seconds F10.4 51-60 times required for the DG data in digital message of day/night condition I and type J. TSIGMA $(2,2)$ seconds F10.4 71-80 I and J are as defined at	TMEAN (1,1)	seconds	F10.4	1-10	TMEAN (I,J) is the mean time for
TMEAN (1,2) seconds F10.4 21-30 $I = 1$ for day time $I = 2$ for night $I = 1$ for pre-planned to (priority or not) $I = 1$ for pre-planned to (priority or not) $I = 1$ for pre-planned to (priority or not) $I = 1$ for pre-planned to (priority or not) $I = 1$ for pre-planned to (priority or not) $I = 1$ for pre-planned to (priority or not) $I = 1$ for pre-planned to (priority or not) $I = 1$ for pre-planned to (priority or not) $I = 1$ for day time $I = 1$ for day ti	TMEAN (2,1)	seconds	F10.4	11-20	message device in day/night condition
TMEAN $(2,2)$ seconds F10.4 31-40 $J = 1$ for pre-planned to priority or not) $J = 2$ for target of opposition of the distribution of the distrib	TMEAN (1,2)	seconds	F10.4	21-30	I = 1 for day time
TSIGMA (1,1) seconds F10.4 41-50 $\frac{1}{1}$ J = 2 for target of opposition of the distribution of the distribution of the distribution of the distribution of the DC data in digital message of day/night condition I and type J. TSIGMA (2,2) seconds F10.4 71-80 I and J are as defined at	TMEAN (2,2)	seconds	F10.4	31-40	J = 1 for pre-planned target
TSIGMA (2,1) seconds F10.4 51-60 times required for the DG data in digital message of day/night condition I and type J. TSIGMA (2,2) seconds F10.4 71-80 I and J are as defined at	TSIGMA (1,1)	seconds	F10.4	41-50	J = 2 for target of opportunity TSIGMA (I,J) is the standard
TSIGMA (1,2) seconds F10.4 61-70 day/night condition I and type J. TSIGMA (2,2) seconds F10.4 71-80 I and J are as defined at	TSIGMA (2,1)	seconds	F10.4	51-60	times required for the DO to enter
TSIGMA (2,2) seconds F10.4 71-80 I and J are as defined at	TSIGMA (1,2)	seconds	F10.4	51-70	data in digital message device under day/night condition I and mission
	TSIGMA (2,2)	seconds	F10.4	71-80	I and J are as defined above for

RESPONSE TIME ____CARD SET

				1
Variable name	UNITS	Format	columns	Nescription
TRARRY (1,1)	seconds	F10.4	1-10	TRARRY (I,J) is the nominal
TRARRY (2,1)	seconds	F10.4	11-20	response time for mission type I and commo type J.
TRARRY (3,1)	seconds	F10.4	21-30	<pre>I = 1 for pre-planned targets I = 2 for targets of opportunity I = 3 for priority pre-planned</pre>
TRARRY (1,2)	seconds	F10.4	31-40	targets.
TRARRY (2,2)	seconds	F10.4	41-50	J = 1 for digital commo
TRARRY (3,2)	seconds	F10.4	51-60	J = 2 for voice commo
				Note: These nominal response times are not to include time-of-flight. (TOF is added in COPE itself to obtain TRBAR)
			!	
		+	14-44	
		i	1 14-44	

4. Direct Fire Suppression Data Block Input.

When reading direct fire suppression data into PREPMS for transfer to TAPE 11, the first card (which indicates that a direct fire suppression data record is to be read) must be of the form:

NEW RECORD, record name, 4

o۳

NEW REC, record name, 4

where record name is the name of the direct fire suppression record to be read (see section 5.3.4 for direct fire suppression record names).

When using the $\underline{\mathsf{TEMPORARY}}$ option with COPE, the direct fire suppression data is headed by a card of the form:

TEMPORARY DIRECT FIRE SUPPRESSION

or

TEMPORARY, DFIRE SUPPR

or

TEMP, DIRECT FIRE SUPPRESSION

or

TEMP, DFIRE SUPPR

In either case (whether reading direct fire suppression data in PREPMS or COPE), the remaining cards of the direct fire suppression data are as follow:

DIRECT FIRE SUPPRESSION CARD SET Card No. 2

/ariable name	UNITS	Format	columns	Nescription
NDFSP		15	1-5	Number of points to be entered for each of the three rows of the DFDOKL array. (Number of range points for DFDOKL array).
				With current dimensions, NDFSP \leqslant 10.
			<u> </u>) !
				;
				! ! !
				!
			1	
		1	14-46	

DIRECT FIRE SUPPRESSION CARD SET Card No. 3a

Variable name	UNITS	Format	columns	Nescription
DFDOKL (1,1) DFDOKL (2,1) OFDOKL (8,1)	meters meters i i meters	F10.4 F10.4 F10.4	1-10 11-20 ! ! 71-80	DFDOKL (I,1) is the range in meters corresponding to a probability of DO being suppressed (obscured) of DFDOKL (I,2) and a probability of DO being killed of DFDOKL (I,3) DFDOKL (1,1) = 0.0 and DFDOKL (I,1) < DFDOKL (I+1,1). If NDFSP>8, then a second card is required for DFDOKL (9,1) through DFDOKL (NDFSP,1).
			14-47	

DIRECT FIRE SUPPRESSION CARD SET Card No. 3b

Variable name	STINU	Format	columns	Nescription
DFDOKL (1,2) DFDOKL (2,2) DFDOKL (8,2)	UNITS	Format F10.4 F10.4	columns 1-10 11-20 1 71-80	DFDOKL (I,2) is the probability that direct fire dust from the target at range DFDOKL (I,1) obscures the DO (but he is not killed). If NDFSP>8, then a second card is needed for DFDOKL (9,2) through DFDOKL (NDFSP,2).
			14-48	

DIRECT FIRE SUPPRESSION CARD SET Card No. 3c

				, 	· · · · · · · · · · · · · · · · · · ·
_	Variable name	UNITS	Format	columns	Nescription
	DFDOKL (1,3) DFDOKL (2,3)		F10.4	1-10 11-20	DFDOKL (I,3) is the probability that direct fire from the target at range DFDOKL (I,1) kills the DO.
	DFDOKL (8,3)	·	1 1 F10.4	1 1 1 71 - 80	If NDFSP > 8, then a second card is needed for DFDOKL (9,3) through DFDOKL (NDFSP,3)
	אלטאנב (טיט)		713.4	,, 55	STEER (METER 40)
				14-49	

5. Random Occurrence Data Block Input.

When reading random occurrence data in PREPMS for transfer to TAPE 11, the first card (which indicates that a random occurrence data record is to be read) must be of the form:

NEW RECORD, record name, 5

or

NEW REC, record name, 5

where record name is the name of the random occurrence record to be read (see section 5.3.5 for random occurrence record names).

When using the TEMPORARY option with COPE, the random occurrence data is headed by a card of the form:

TEMPORARY, RANDOM OCCURRENCE DISTRIBUTION

or

TEMPORARY, RODIST

or

TEMP, RANDOM OCCURRENCE DISTRIBUTION

or

TEMP, RODIST

In either case (whether reading random occurrence data in PREPMS or COPE), the remaining cards of the random occurrence data are as follow:

RANDOM OCCURRENCE DATA CARD SET

Variable name	UNITS	Format	columns	Description
NPLOSR		15	1-5	Number of range classes for probability of LOS data for random occurrence.
				Current dimensions require NPLOSR≤10.
			•	
			· -	
		-	14-51	

RANDOM OCCURRENCE DATA CARD SET Card No. 3

seconds	F10.4	1-10	Critical time for laser designation (i.e., the length of the time interval immediately prior to impact during which the target must be continuously lased in order to have a successful Copperhead mission).
			14-52

RANDOM OCCURRENCE DATA CARD SET

Variable name	UNITS	Format	columns	Nescription
RNGPLS (1) RNGPLS (2) I I RNGPLS (8)	meters i i i meters	F10.4 F10.4 F10.4	1-10 11-20 1 1 71-80	RNGPLS (I) is the upper limit of the Ith range class for random occurrence line of sight data. Range class I extends from zero to RNGPLS (I); range class I for I>I extends from RNGPLS (I) to RNGPLS (I+1). RNGPLS (I+1). RNGPLS(I) < RNGPLS (I+1) If NPLOSR>8, then a second card must be used to contain RNGPLS (9) through RNGPLS (NPLOSR).
		1.	14-53	

RANDOM OCCURRENCE DATA CARD SET

Variable name	UNITS	Format	columns	ⁿ escription .
PRBLOS (1) PRBLOS (2)		F10.4	1-10	PRBLOS (I) is the probability that a single vehicle in range class I is in view of the DO for the final TCRIT seconds of the Copperhead flight.
PRBLOS (8)		F10.4	71-80	If NPLOSR >8, then a second card is needed to contain PRBLOS(9) through PRBLOS(NPLOSR).
:				
	•		14-54	

6. PE Data Block Input.

When reading PE data in PREPMS for transfer to TAPE 11, the first card (which indicates that a PE data record is to be read) must be of the form:

NEW RECORD, record name, 6

or

NEW REC, record name, 6

where record name is the name of the PE data record to be read (see section 5.4 for PE record names).

When using the TEMPORARY option with COPE, the PE data are headed by a card of the form:

TEMPORARY, PEDATA

or

TEMP, PEDATA

In either case (whether reading PE data in PREPMS or COPE), there is an optional card that can be inserted next:

USE TAPE 4

If this card is used, then the program (PREPMS or COPE) reads the remaining cards of the PE data from I/O unit 4 instead of the normal I/O unit 5; if this card is not used, then the PE data are read from I/O unit 5. In either case (whether I/O unit 4 or 5 is used), the remaining PE data cards are as described after this note:

Note: Because the PAM program (see Chapter 16) can write the PE data records directly to TAPE 11 without any need to run PREPMS, it is very unlikely that the need will arise to use PREPMS (or COPE) to read PE data as described in this section; however, the capability is provided.

PE DATA CARD SET

Card No. <u>2a - 2dd</u>

Variable name	UNITS	Format	columns	ⁿ escription
INDEX (I,J,1) INDEX (I,J,2)		I5 I5	1-5	INDEX (I,J,K) = 10*(I-1)+2*(J-1)+K where K = 1,2 J = 1,2,,5 I = 1,2,,6
				The values are read two to a card and the values are arranged varying K first, then J, and then I.
				This procedure yields a set of 30 cards. The Nth such card having the values (2N-1) and 2N on it in 2I5 format.
				The index array is used to access the PETBL array.
	:			
			"	
	•		14-56	

PE DATA CARD SET

Card No. <u>3a - 3b²⁴</u> (600 cards)

Variable name	UNITS	Format	columns	Nescription
PETBL (I,J,1)		F10.4	1-10	PETBL (I,J,K) is the probability
PETBL (I,J,2)		F10.4	11-20	of engagement value for DU-to-targe range K, visibility range J, and index value I.
PETBL (I,J,3)		F10.4	21-30	The values are input seven per card so that K varies first, then J,
PETBL (I,J,4)		F10.4	31-40	and finally I. K = 1,2,,7
PETBL (I,J,5)		F10.4	41-50	J = 1, 2,, 10 I = 1, 2,, 60.
PETBL (I,J,6)		F10.4	51-60	
PETBL (I,J,7)		F10.4	61-70	This makes for a total of 600 cards with seven entries per card in 7F10.4 format.
			1	!
			ļ	
			14-57	

7. Posture Data Block Input.

When reading posture data in PREPMS for transfer to TAPE 11, the first card (which indicates that a Target Posture data record is to be read) must be of the form:

NEW RECORD, record name, 7

or

NEW REC, record name, 7

where record name is the name of the target posture data to be read (see section 5.3.6 for target posture record names).

When using the <u>TEMPORARY</u> option with COPE, the target posture data are headed by a card of the form:

TEMPORARY, TARGET POSTURE DISTRIBUTION

or

TEMPORARY, TGTPSTDIST

or

TEMP, TARGET POSTURE DISTRIBUTION

or

TEMP, TGTPSTDIST

In either case (whether reading target posture data in PREPMS or COPE), the remaining cards of the target posture data are as follow:

POSTURE DATA ____CARD SET

Variable name	UNITS	Format	columns	Nescription
NRNGPS		15	1-5	Number of range classes used for target posture data.
				Current dimensions require NRNGPS ≤ 10.
!				
,			, 14- 59	

POSTURE DATA CARD SE

____CARD SET Card No. __3

Variable name	UNITS	Format	columns	Description
RNGPST (1)	meters	F10.4	1-10	RNGPST (I) is the upper limit of the Ith range class for posture
RNGPST (2)	meters	F10.4	11-20	data.
RNGPST (3)	meters	F10.4	21-30	The first range class runs from zero to RNGPST (1); the Ith range class extends from RNGPST (I) to RNGPST (I+1).
RNGPST (8)	meters	F10.4	71-80	Note RNGPST (I) < RNGPST (I+1) Also, if NRNGPS>8, the a second card is required: for RNGPST (9) through RNGPST (NRNGPS).
			14-60	

POSTURE DATA ____CARD SET

Card No. ___4a

Variable name	UNITS	Format	columns	Nescription
PSTTBL (1,1) PSTTBL (2,1)		F10.4 F10.4	1-10 11-20 71-80	PSTTBL (I,1) is the probability that the target is completely obscured when at DO-to-target range RNGPST (I). If NRNGPS > 8, then a second card is required for PSTTBL (9,1) through PSTTBL (NRNGPS,1).
			14-61	

POSTURE DATA CARD SET Card No. 4h

Variable name	UNITS	Format	columns	Nescription
PSTTBL (1,2) PSTTBL (2,2) I PSTTBL (8,2)	UNITS	Format F10.4 F10.4 F10.4 F10.4	columns 1-10 11-20	PSTTBL (I,2) is the probability that the target is fully exposed when at DO-to-target range RNGPST (I). As usual, if NRNGPS> 8, a second card is needed for PSTTBL (9,2) through PSTTBL (NRNGPS,2).
			14-62	

POSTURE DATA CARD SET

Card No. 4c

Variable name	UNITS	Format	columns	Nescription
PSTTBL (1,3) PSTTBL (2,3) PSTTBL (8,3)	UNITS	Format F10.4 F10.4 I I F10.4	columns 1-10 11-20	PSTTBL (I,3) is the probability that the target is hull defilade (turret exposed) when at a no-to-target range of RNGPST (I). Again, if NRNGPS>8, a second card is needed for PSTTBL (9,3) through PSTTBL (NRNGPS,3).
			14-63	

8. Invariant Data Block.

When reading invariant data in PREPMS for transfer to TAPE 11, the first card (which indicates that an invariant data record is to be read) must be of the form:

NEW RECORD, record name, 8

or

NEW REC, record name, 8

where record name is the name of the invariant data record to be read (see section 5.3.7 for invariant data record names).

When using the TEMPORARY option with COPE, the invariant data is headed by a card of the form:

TEMPORARY, INVARIANT

or

TEMP, INVARIANT

In either case (whether reading invariant data in PREPMS or COPE), the remaining cards of the invariant data are as follow:

INVARIANT	DATA	CARD	SET
THANKINTULL	חות		

Card	No.	2	
Garu	110 .	_	

Variable name	UNITS	Format	columns	Pescription
NRNGTT		15	1-5	The number of range classes used with the LDWSS probability of hit numbers.
				NRNGTT≤ 20 with current dimensions.
		i		
		i i	 	
				:
		+	14-65	j

INVARIANT DATA CARD SET Card No. 3a - 3t

Variable name	UNITS	Format	columns	Nescription
RNGTTF (J)	meters	F10.4	1-10	RNGTTF (J) is the Ith range at which probability of hit data is entered. RNGTTF (1) = 0.0 and RNGTTF (I) < RNGTTF (I+1).
TTF (1,J,1)		F10.4	11-20	TTF (I,J,K) is the probability of hit at range J using designator
TTF (1,J,2)		F10.4	21-30	type I against a target in posture K. I = 1 for GLLD
TTF (2,J,1)		F10.4	31-40	I = 2 for MULE I = 3 for LTD
TTF (2,J,2)		F10.4	41-50	K = 1 for fully exposed K = 2 for hull defilade (turret
TTF (3,J,1)		F10.4	51-60	exposed)
TTF (3,J,2)		F10.4	61-70	There will be NRNGTT cards of this ty with each card containing the same data points as its predecessor but for the next J value.
				There will be a maximum of 20 such cards.
		İ		i !
				1
				; ;
				1
		·		
			!	
		1	14-66	

INVARIANT DATA

____CARD SET Card No. 4_____

Variable name	UNITS	Format	columns	Nescription
DLTT (1)	seconds	F10.4	1-10	DLTT (I) is the Ith response time delay value to be used in interpolating with respect to
DLTT (2)	seconds	F10.4	11-20	delay time in the PETBL array.
DLTT (3)	seconds	F10.4	21-30	DLTT (1) = 0.0 and DLTT (1) < DLTT (I+1).
DLTT (4)	seconds	F10.4	31-40	DETT (1) - BETT (111).
DLTT (5)	seconds	F10.4	41-50	
DLTT (6)	seconds	F10.4	51-60	
			4	; ;
			14.67	
		1	14-67	

INVARIANT DATA CARD SET Card No. 5a

Variable name	UNITS	Format	columns	Description
PKTBL (1,1)		F10.4	1-10	PKTBL (I,1) is the probability
PKTBL (2,1)		F10.4	11-20	of kill given a Copperhead hit against target type I in a fully
PKTBL (3,1)		F10.4	21-30	exposed posture,
PKTBL (4,1)		F10.4	31-40	
PKTBL (5,1)		F10.4	41-50	
PKTBL (6,1)		F10.4	51-60	! :
PKTBL (7,1)		F10.4	61-70	
			i !	
]	14-68	

INVARIANT DATA ____CARD SET

Card No. 5b

Variable name	UNITS	Format	columns	Description
PKTBL (1,2) PKTBL (2,2) PKTBL (3,2) PKTBL (4,2) PKTBL (5,2) PKTBL (6,2) PKTBL (7,2)	UNITS	F10.4 F10.4 F10.4 F10.4 F10.4 F10.4	columns 1-10 11-20 21-30 31-40 41-50 51-60 61-70	PKTBL (I,2) is the probability of kill given a Copperhead hit against target type I in a hull defilade (turret exposed) posture.
			14-69	

to PREPMS is a line of the form:

The third type of input

REPORT RECORD LIST

or

REP REC LIST

Inserting this line (card or card image) in the PREPMS input will cause the program to print a list of the names of the records on TAPE 11 at the time the line is encountered.

The usual practice is to place a line of this type in the input after all of the option word records and data block records so that the list produced will include all of the records created by the current run.

An example of the list produced is shown in Appendix C.

14.4.4 INTERPRET PEDATA Directive. The fourth type of input to PREPMS is a line of the form:

INTERPRET PEDATA

Inserting a line of this form in the PREPMS input will cause the program to print a list of the names of the current PE data records on TAPE 11 as well as the values of the nine parameters corresponding to each such record (see section 5.4).

14.5 PREPMS Output.

PREPMS writes to two files, TAPE 11 and TAPE 6 (also called OUTPUT). TAPE 11 receives the data block records, the option word records, the record named OPTNNUMS (which is automatically maintained by PREPMS with no user attention), and the record index array which is automatically maintained by the CDC word addressable mass storage file facilities. TAPE 6 (usually a line printer) is a sequential file on which PREPMS echoes the inputs that create the data block records and option name records as well as prints the lists generated by INTERPRET PEDATA and REPORT RECORD LIST directives.

A sample of PREPMS output (TAPE 6) is given in Appendix C, so further discussion is not given here.

14.6 PREPMS Diagnostic Messages.

Since several of the subroutines used by PREPMS are similar to those used in COPE, any diagnostic messages not found in this section (which gives only the PREPMS-peculiar messages) should be given in Chapter 7.

14.6.1 Messages of Informational Nature Not Terminating Program.

1. **PREPMS** NON-FATAL WARNING! YOU HAVE SEQUENCE NUMBERS IN COLS. 73-78 OF TAPES. THEY WILL BE REMOVED BY THE PROGRAM; HOWEVER, THE RESULTS MAY BE SUSPECT.

This message is generated in SEPRC2 and is caused when the computer detects editor sequence numbers in the INPUT file (see section 7.1).

This message does not stop the program; however, it is very probable that the wrong data has been used if this message is printed. Great care should be taken to assure that the OUTPUT shows the correct (intended) values and that no sequence numbers were taken as input.

Note that the sequence numbers are removed only from those lines entered in free format. All lines entered as formatted data will still have sequence numbers which may be read instead of the intended data (for columns 73-78).

To avoid this problem, one should always use an 80 character line length when editing the input file for PREPMS (i.e., F,CH=80 on CDC).

2. **PREPMS** THIS IS A CREATION RUN FOR RECORD OPTNNUMS.

This message is not really a diagnostic but merely indicates to the user that this run of PREPMS creates a new TAPE 11. If this message is not present, it means that the current PREPMS run is modifying an existing TAPE 11 rather than creating a new one.

14.6.2 STOPS With Messages in Day Files.

1. STOP IN PREPMS: ERROR NUMBER 1.

This stop occurs when the program has read an input card which should be the first card of one of the four input types of section 14.4, but does not recognize the card as one of those four types.

This error is most likely to happen when either the card is mispunched or the previous input set (especially if it was type 1 or type 2 input) has the wrong number of cards.

2. STOP IN PREPMS: ERROR NUMBER 2.

This error occurs when the third field of a type 1 card of a type 1 input is not a number. (That is, the option word record input type starts with a card that has a non-numeral for the value of NREAD. See section 14.4.1 for the correct form of this card type).

3. STOP IN PREPMS: ERROR NUMBER 3.

This error occurs when the fourth field of a type 1 card (the value of NOPT1) of a type 1 input is not a number. (See section 14.4.1 for the correct form of this card type).

4. STOP IN PREPMS: ERROR NUMBER 4.

This error occurs when the first field of a type 2 card of a type 1 input is not a number. Again, see section 14.4.1 for the correct form of this card.

5. STOP IN PREPMS: ERROR NUMBER 5.

This error occurs when the second field of a type 2 card of a type 1 input is not a number. See section 14.4.1 for the correct form of this card.

6. STOP IN PREPMS: ERROR NUMBER 6.

This error occurs when the third field of the first card of a type 2 input is not a number. See section 14.4.2 (subsections 1 through 8) for the proper first card form for this input type.

7. STOP IN PREPMS: PROGRAM TERMINATION.

This means that the program reached the end of a file on TAPE 5 (INPUT) without any errors detected. It is the message that accompanies a successful run, but of course it is no guarantee that the data are correct (only that they are formatted in a valid form).

8. STOP IN SEPRC2: ERROR NUMBER 1.

This stop occurs only if the number of fields on a free formatted input card is greater than 10 or less than or equal to 0.

15. PRBLOS PREPROCESSOR

The PRBLOS preprocessor is used to calculate the probability that a target randomly located along a route of approach within a certain designator-to-target range band will be in the line-of-sight of the designator for at least the final critical seconds of the COPPERHEAD trajectory.

This chapter gives: (1) the mathematical derivation of the method for computing the probability mentioned above, (2) a description of the program, (3) a glossary of program variables, (4) description of inputs, and (5) description of outputs. A program listing along with sample inputs and the resulting outputs are given in Appendix B.

15.1 Method For Calculating PRBLOS.

For a particular designator-to-target range band (e.g., ranges 2000m to 3000m) define F and G to be the cumulative distribution functions for in-view and out-of-view segment lengths respectively. That is, the probability that a randomly selected LOS segment for the given range band is of length less than or equal to X is F(X); the probability that a randomly selected out-of-view segment in the given range band is of length less than or equal to X is G(X).

Let t_{C} be the critical time; that is the time interval at the end of the COPPERHEAD trajectory during which the target must be designated in order for the COPPERHEAD to track and hit the target. Also, let v_{t} be the target velocity (target velocity is assumed constant).

Then the history of a target's exposure can be thought of as a sequence of alternating in-view and out-of-view segments. For example, the sequence f_1 , g_1 , f_2 , g_2 , f_3 , g_3 ----, h_n , where the f_i 's are in-view segment lengths forming a sample from a population of segment lengths distributed according to the cumulative distribution F, the g_i 's are out-of-view segment lengths forming a sample from a population of segment lengths distributed according to cumulative distribution G, and h_n is the last segment which is either an f_i or a g_i depending on whether the final segment is in-view or out-of-view.

Then for a particular target's exposure (i.e., in-view, out-of-view) history, one can calculate its probability of being in-view as probability target is in-view = fraction of target's path in-view =

$$\frac{\sum_{i=1}^{N} f_{i}}{\sum_{i=1}^{N} f_{i} + \sum_{i=1}^{M} g_{i}}$$

where M is equal to either N or N-l depending on whether the last segment is respectively out-of-view or in-view.

In our problem though, we do not want the probability that the target is in-view, but rather the probability that it is in-view and will remain in-view for the next t_{C} time units. This means that the target must be in an in-view segment and be at least $t_{\text{C}} * v_{\text{t}}$ distance from the end of that segment. The probability that the target is in such a location is equal to the fraction of the target's path that consists of points that are in-view and at least a distance $t_{\text{C}} * v_{\text{t}}$ from the next out-of-view segment.

For each in-view segment either (1) $f_i \le t_c * v_t$ in which case that in-view segment contributes nothing to the total path length satisfying the conditions, or (2) $f_i > t_c * v_t$ distance from the next out-of-view segment.

Therefore, we have:

probability target is in-view and at least $t_c * v_t$ distance from next out-of-view segment =

fraction of target's path that is in-view and at least t_c*v_t distance from the next out-of-view segment =

$$\frac{\sum_{i=1}^{N} \max \{0, f_i - t_c * v_t\}}{\sum_{i=1}^{N} f_i + \sum_{i=1}^{M} g_i}$$

where M and N are as before and max $\{0, t_i - t_c * v_t\}$ is the length contributed by the ith in-view segment to the total path length that is in-view and at least $t_c * v_t$ away from the next out-of-view segment.

Note: max $\{0, f_i-t_c*v_t\}$ means that the ith term of the sum is to be the maximum of the two quantities 0 and $(f_i-t_c*v_t)$.

Let S_i = max $\{0, f_i-t_c*v_t\}$ then the S_i 's can be obtained by sampling f_i 's from a population with cumulative distribution F and then applying the formula S_i = max $\{0, f_i-t_c*v_t\}$. This is equivalent to sampling from a population with cumulative distribution S where:

$$S(0) = F(t_c*v_t)$$
 and
 $S(X) = F(x + t_c*v_t)$ for $x > 0$.

Hence, our probability that the target is in-view and at least $t_c \\^*v_t$ from the next out-of-view segment can be written:

$$\frac{\frac{1}{N}\sum_{i=1}^{N} \max \{0, f_{i}^{-t}c^{*v}_{t}\}}{\frac{1}{N}\sum_{i=1}^{N} f_{i}^{+} \frac{1}{N}\sum_{i=1}^{M} g_{i}}$$

Now to obtain an overall estimate of this probability (which we call PRBLOS) we can imagine that we let our target wander back and forth over the various paths in the given range band. As this is done, N $\rightarrow \infty$ (and also M/N \rightarrow 1) so that

$$\begin{split} &\frac{1}{N}\sum_{i=1}^{N} \text{ } f_{i} \rightarrow \text{M}_{f} \text{ } (\text{mean of } f_{i} \text{ population}) \\ &\frac{1}{N}\sum_{i=1}^{M} \text{ } g_{i} \rightarrow \frac{\text{M}}{N} \left\{ \frac{1}{M}\sum_{i=1}^{M} g_{i} \right\} \rightarrow \frac{\text{M}}{N} \text{M}_{g} \rightarrow \text{M}_{g} \text{ } (\text{mean of } g_{i} \text{ population}) \\ &\frac{1}{N}\sum_{i=1}^{N} \text{ } \max \text{ } \{0, \text{ } f_{i}\text{-}t_{c}\text{*}v_{t}\} = \frac{1}{N}\sum_{i=1}^{N} \text{ } s_{i}\text{+}M_{s} \text{ } (\text{mean of } s_{i} \text{ population}) \end{split}$$

Therefore,

$$PRBLOS = \frac{M_s}{M_f + M_q}$$

is used as the probability that a vehicle randomly located in a given range band is in-view (from the designator's position) and will remain in-view for at least $\mathbf{t}_{_{\mathbf{C}}}$ time units.

15.2 Description of PRBLOS Program and Glossary of Variables.

The program is extremely simple and consists of nothing but the steps required to perform the calculations described in 15.1 as well as to read the input and print the results.

The program can be summarized as four main steps:

- (1) Read the input for the next case and print it for checking purposes; if no input, stop.
- (2) Form the modified distribution (the one with cumulative distribution function S in section 15.1) and print it.
- (3) Calculate the means of the three distributions F, G, and S (i.e., $M_{\mbox{f}},\ M_{\mbox{g}},\ M_{\mbox{S}})$ and from that calculate PRBLOS.
- (4) Print PRBLOS and return to step (1) to see whether there is another case.

The subroutine AVEL of the program computes the mean of a distribution with cumulative distribution function F by using the formula:

$$M_{f} = \int_{L}^{U} xf(x)dx = UF(U)-LF(L) - \int_{L}^{U} F(x)dx$$

where f is the probability density function (i.e., f = F' almost everywhere) and U and L are respectively the upper and lower bounds of the distribution (in our cases, $0 < L < U < \infty$).

Since F is defined in the program by an array of ordered pairs (x_i, F_i) i = 1, 2...K where F_i = probability that x is less than or equal to x_i , it is possible to approximate the right most integral by:

(*)
$$\int_{1}^{U} F(x) dx \approx \frac{1}{2} \sum_{i=1}^{K-1} (x_{i+1} - x_{i}) (F_{i+1} + F_{i}).$$

Hence, the subroutine AVEL calculates the mean of a population with cumulative distribution function F using the formula:

$$M_{f} = x_{K} F_{K} - x_{1}F_{1} - \frac{1}{2} \sum_{i=1}^{K-1} (x_{i+1} - x_{i})(F_{i+1} + F_{i}).$$

The actual variable names used in the program are different from those used in sections 15.1 and 15.2; however, they are defined in the variable glossary so understanding should be fairly easy.

		NOWICO	GLOSSAF	GLOSSARY OF PRBLOS VARIABLES
VARIABLE	TYPE	BLOCK	UNITS	DEFINITION
A(6)		(L0CAL)		The A array contains up to 60 alphamuneric characters used as a case title
AVE		(LOCAL) (F.P.)	meters	AVE is the value returned by subroutine AVEL as the mean length of the distribution with which it (AVEL) was called
AVEIV		(L0CAL)	meters	AVEIV is the mean length of the in-view segment lengths (Mp of section 15.1)
AVEIVM		(LOCAL)	meters	AVEIVM is the mean length of the modified in-view segment lengths (M $_{\!_{\rm K}}$ of section 15.1)
AVE00V		(LOCAL)	meters	AVEOOV is the mean length of the out-of-view segment lengths (M_{α} of section 15.1)
CD		(LOCAL)	meters	CD is the critical distance; that is, the distance that the target will cover during the critical time ($t_c^*v_t$ in the notation of section 15.1)
н		(LOCAL)		I is used as a DO-LOOP control variable and as a subscript value.
r		(LOCAL)		J is used as a DO-LOOP control variable and as a subscript value.
¥		(LOCAL)		K is used as a DO-LOOP control variable and as a subscript value.
NIV		(LOCAL)		NIV is the number of points (ie, pairs, PRIV(I,1) and PRIV(I,2) used in the current case to describe the cumulative in-view segment length distribution (NIV ≤ 20 with current program dimensions)
NIVM		(LOCAL)		NIVM is the number of points (ie, pairs PRIVM(I,1) and PRIVM(I,2) used in the current case to describe the cumulative modified inview segment length distribution (NIVM \leq 20 with current program dimensions).
NOON		(LOCAL)		NOOV is the number of points (ie, pairs PROOV(I,1) and PROOV(I,2) used in the current case to describe the cumulative out-of-view segment length distribution (NOOV < 20 with current program dimensions).
NU		(LOCAL)		NU is equal to one less then the number of points used to describe the cumulative distribution whose mean is being calculated by subroutine AVEL. It is the number of terms in the sum of equation (*) of section 15.2.
[N		(LOCAL) (F.P.)		NI is the first dimension of the P array. In this program, NI is always equal to 20.

		NOMMOD	GLOSSARY OF PRB	GLOSSARY OF PRBLOS VARIABLES - CONTINUED
VARIABLE	ТҮРЕ	BLOCK	UNITS	DEFINITION
N2		(LOCAL) (F.P.)		N2 is the second dimension of the P array. In this program, N2 is always equal to 2.
N3		(LOCAL) (F.P.)		N3 is the number of points used to describe the cumulative distribution whose mean is being calculated by subroutine AVFI
P(N1,N2)		(LOCAL) (F.P.)	P(I,2) is in meters	P(I,1) is the probability that a segment length (randomly selected from the population whose mean is now being calculated by subroutine AVEL) is less than or equal to $P(I,2)$. (where I=1, 2,, N3).
PRBIVM		(LOCAL)		This is the variable PRBLOS of section 15.1 (Since the program card uses PRBLOS as the program name it was necessary to call the variable by another name) It is the probability that a vehicle randomly located along an approach path in the given range band is currently in view and will remain in view for at least t seconds.
PRIV(20,2)		(LOCAL)	PRIV (1,2) is in meters	PRIV is the array describing the cumulative distribution of inview segment lengths (F of section 15.1) PRIV (I,1) is the probability that a randomly chosen in-view segment is of length PRIV(I,2) or less.
PRIVM(20,2)		(LOCAL)	PRIVM(I,2) is in meters	PRIVM is the array describing the cumulative distribution of modified in-view segment lengths (S of section 15.1). PRIVM(I,1) is the probability that a randomly chosen modified in-view segment is of length PRIVM(I,2) or less.
PROOV(20,2)		(LOCAL)	PROOV(I,2) is in meters	PROOV is the array describing the cumulative distribution of out-of-view segment lengths (G of section 15.1), PROOV(I,1) is the probability that a randomly chosen out-of-view segment is of length PROOV(I,2) or less.
SUM		(LOCAL)		SUM is the value of the summation of equation (*) of section 15.2.
10		(L0CAL)	seconds	TC is the critical time (t _c of section 15.1) It is the duration of the interval at the end of the Copperhead trajectory during which the target must be (nearly) continuously lased in order that the round can track and hit the target.
TGTVEL		(LOCAL)	meters/sec.	TGTVEL ($v_{f t}$ of section 15.1) is the velocity of the target.

15.3 PRBLOS Inputs.

For each case that is to be run with the PRBLOS program, a set of input cards (or card images) composed of card types I through 5b must be prepared. Multiple cases can be run by simply stacking cardsets for the various cases one after another. The first card of each case has room (columns 21 through 80) for an identifying alphanumeric string which is reproduced on output for easier case identification. The program runs all cases until it either runs out of input or encounters an illegal input value.

Since the normal use of the PRBLOS program is to calculate the values to fill the RANDOM OCCURRENCE Data Block of COPE (in particular the PRBLOS array), each case run of the PRBLOS program corresponds to a given terrain, target velocity, and range band combination. For consistency, the PRIV data for PRBLOS should be obtained from the same source as the SEGLOS data for COPE. (Indeed, there is no reason why for a given terrain the same values cannot be used for PRIV(I,1) as for SEGLOS (I,1) and for PRIV(I,2) as for SEGLOS (I,J) in the (J-1)th range band.)

TGTVEL, TC, A CARD SET

CARD NO. 1

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
TGTVEL	meters/sec.	F10.4	1-10	The velocity of the target
TC	seconds	F10.4	11-20	The critical time
A(1)		AIO	21-30	A(1) through A(6) can be used to hold up to 60 characters of case heading which are copied from this card to the first output line of each case. This has no effect on calculations but enables the user to label the cases.
A(2)		AIO	31-40	
A(3)		A10	41-50	
A(4)		AIO	51-60	
A(5)		A10	61-70	
A(6)		A10	71-80	
				15-8

NIV ____CARD SET

CARD NO. 2

PRIV (I,1) CARD SET

CARD NO. 3a

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
PRIV(1,1)		F10.5	1-10	PRIV(I,1) is the probability that a randomly chosen in-view segment has length less than or equal to PRIV(I,2).
PRIV(2,1)		F10.5	11-20	
PRIV(3,1)		F10.5	21-30	NOTE: PRIV(I,1) < PRIV(I+1,1) for
PRIV(4,1)		F10.5	31-40	$I = 1,2, \overline{NIV}-1;$ $0 \leq PRIV(I,1) \leq 1$ for I = 1,2,NIV; and
PRIV(5,1)		F10.5	41-50	PRIV(NIV,1) = 1.0
PRIV(6,1)		F10.5	51-60	If NIV > 8, then an additional card (or two)
PRIV(7,1)		F10.5	61-70	is needed for PRIV(9,1) through PRIV(NIV,1) The additional card(s) should have 8F10.4
PRIV(8,1)		F10.5	71-80	format also. PRIV(I,1) and PRIV(I,2) together correspond to the F_i and X_i values respectively (in the notation of section 15.2) for the in-view distribution.
				15-10

PRIV (I,2) CARD SET

CARD NO. 3b

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION	
PRIV(1,2)	meters.	F10.5	1-10	PRIV(I,2) is the in-view segment length	
PRIV(2,2)	meters	F10.5	11-20	corresponding to cumulative probability PRIV(I,1)	
PRIV(3,2)	meters	F10.5	21-30	NOTE:	
PRIV(4,2)	meters	F10.5	31-40	PRIV(I,2) < PRIV(I+1,2) for I = 1,2,,NIV-1	
PRIV(5,2)	meters	F10.5	41-50		
PRIV(6,2)	meters	F10.5	51-60	If NIV>8, then an additional card (or two) is needed for PRIV(9,2) through	
PRIV(7,2)	meters	F10.5	61-70	PRIV(NIV,2). The additional card(s) have 8F10.4 format.	
PRIV(8,2)	meters	F10.5	71-80	or 10.4 Torniat.	
				15-11	

NOOV	CARD SET	CARD NO. 4
11001	CHKD 3E i	CARD NO. 4

ARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
NOOV		15	1-5	NOOV is the number of points to be read to describe the cumulative out-of-view segment length distribution. NOOV controls reading of PROOV: PROOV(I,1) for I=1,2,NOOV PROOV(I,2) for I=1,2,NOOV NOTE: Current dimensions require NOOV \(\leq 20.\)
				15-12

PROOV (I,1) ___CARD SET

CARD NO. 5a

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
PR00V(1,1)		F10.4	1-10	PROOV(I,1) is the probability that a randomly
PROOV(2,1)		F10.4	11-20	chosen out-of-view segment has length less than or equal to PROOV(I,2).
PROOV(3,1)		F10.4	21-30	NOTE:
PROOV(4,1)		F10.4	31-40	PROOV(I,1) < PROOV (I+1,1) for I = 1,2,,NOOV-1;
PROOV(5,1)		F10.4	41-50	$0 \leq PROOV(I,1) \leq 1.0 \text{ for}$ $I = 1,2, NOOV; \text{ and}$
PROOV(6,1)		F10.4	51-60	PROOV (NOOV ,1) = 1.0
PROOV(7,1)		F10.4	61-70	If NOOV > 8, then an additional card(or two)
PROOV(8,1)		F10.4	71-80	is needed for PROOV(9,1) through PROOV(NOOV,1) The additional card(s) should have 8F10.4 format.
				PROOV(I,1) and PROOV(I,2) correspond to a point on the cumulative distribution G of section 15.1 (a point with coordinates (PROOV(I,2),PROOV(I,1)) in the usual notation.
	:			
				15-13

PROOV(I,2) CARD SET

CARD NO. 5b

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION	
PROOV(1,2)	meters	F10.4	1-10	PROOV(I,2) is the out-of-view segment length corresponding to cumulative	
PROOV(2,2)	meters	F10.4	11-20	probability PROOV (I,1).	
PROOV(3,2)	meters	F10.4	21-30	NOTE:	
PROOV(4,2)	meters	F10.4	31-40	$PROOV(I,2) \le PROOV (I+1,2)$ for $I = 1,2,,NOOV-1$;	
PROOV(5,2)	meters	F10.4	41-50	$0.0 \le PR00V(I,2) \le 1.0$ for $I = 1, 2,, N00V$.	
PROOV(6,2)	meters	F10.4	51-60	1 - 1, 2,,1000	
PROOV(7,2)	meters	F10.4	61-70	If NOOV > 8, then an additional card (or two) is needed for PROOV(9,2) through	
PROOV(8,2)	meters	F10.4	71-80	PROOV(NOOV,2). The additional card(s) have 8F10.4 format.	
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				15-14	

15.4 PRBLOS Output and Diagnostics.

15.4.1 Output. The output of the PRBLOS program is very brief and easy to understand.

For each case run, the first line of output prints the case identifier (if any). The next line prints the target velocity and critical time values. Then comes the PRIV array preceded by NIV. Next the PROOV array preceded by NOOV and the PRIVM array preceded by NIVM. Finally, it prints the average segment lengths of the three distributions and the PRBLOS value followed by the words "END OF CASE".

In the special case that t_c*v_t is greater than the longest possible in-view segment, a message to that effect is printed along with the value of PRBLOS (namely, 0.0). In this case, the PRIVM array is not printed.

Note that PRBIVM is labeled PRBLOS when printed. (This is because PRBIVM is a second choice name for PRBLOS used only because the program card name PRBLOS prevented the use of a variable PRBLOS in the program).

A program listing as well as sample input and output for PRBLOS is contained in Appendix $\ensuremath{\mathsf{B}}_{\bullet}$

15.4.2 Diagnostic ("STOP") Messages in Dayfile.

1. STOP END OF INPUT.

This message means that the program has encountered the end of file of TAPE5 (INPUT). This is the normal program termination message, but of course, it is no guarantee that the results are correct.

2. STOP NIV>20 EXCEEDS DIMENSIONS OF PRIV ARRAY.

This message means the user attempted to read in an NIV value greater than 20. It may occur because NIV is not right justified in columns 1-5 of its input card. Of course, it may also occur if NIV is really greater than 20; if this is the case, then the user must either use fewer points to describe PRIV or redimension PRIV in the program (and change NI in first call of AVEL. Redimensioning of PRIVM and changing NI in the third call of AVEL may also be required).

3. STOP NOOV>20 EXCEEDS DIMENSIONS OF PROOV ARRAY.

This message means the user attempted to read in an NOOV value greater than 20. It may occur because NOOV is not right justified in columns 1-5 of its input card. Of course, it may also occur if NIV is really greater than 20; if this is the case, then the user must either use fewer points to describe PROOV or redimension PROOV in the program (and change N2 in the second call of AVEL).

CHAPTER 16

16. PAM PREPROCESSOR

Unlike the other programs documented in this report (COPE, PREPMS, and PRBLOS), the PAM program was not written by the author of this report. Since the author (Michael Starks, GWD, AMSAA) of PAM will document it in a separate report, this chapter is limited to a brief explanation of the program's purpose and a description of the input. Appendix A contains a program listing as well as sample inputs and outputs.

16.1 General Description of PE Program (PAM).

The PAM program is used to compute the probability of engagement of the target by the COPPERHEAD seeker. More precisely, probability of engagement (PE) is the probability that the COPPERHEAD seeker receives enough reflected laser energy from the target for the COPPERHEAD round to initiate maneuver toward the target and that the target is within the maneuver footprint of the COPPERHEAD.

The PAM model produces a table of 4200 PE values (6 cloud ceiling altitudes x 10 meteorological visibility limits x 5 delay times x 7 designator-to-target ranges x 2 "MUTS" factors). (The multi-unit target factor ("MUTS" factor) allows TLE to be reduced when the predicted impact point is bracketed by a column of target vehicles.)

Such a table then has PE values as a function of cloud ceiling, visibility limit, delay time, MUTS factor, and designator-to-target range. In addition, the set of PE's in the table is a function of the 9 parameters mentioned in section 5.4 (namely, nominal response time, designator type (power), target velocity, gun-target range, reflectivity of target, angle T, deflection bias (distance between footprint centroid and target path point of closest approach), target heading, and seeker sensitivity). Hence, for each different combination of values of the 9 parameters a different set of PE values is needed which, in turn, requires another run of the PAM program.

The PAM program includes the code mentioned in section 5.4 that generates PE data block record names from the values of the 9 parameters. The subroutine PENAM2 is included in PAM and is identical to the PENAME subroutine in COPE and PREPMS except for the change in name and the fact that the data statement for the XVALUE array is included in PENAM2 rather than in a separate BLOCK DATA subprogram as in COPE and PREPMS. The error stops with messages produced by PENAM2 correspond to those for PENAME as explained in section 7.5.

Assuming that the user runs PAM with values of the 9 parameters that are permitted by PENAME (see section 5.4 and discussion of XVALUE array), then a PE DATA record name is generated. The PE values are loaded in the arrays PE (for writing to TAPE 11 as a PE data record for use by COPE) and PENG (for writing to TAPE 6 (output) to provide a hard copy of the PE values).

In order that the values written to TAPE 11 are accessible by COPE, of course, it is necessary to catalog TAPE 11 and use it with the COPE runs. The interface between PAM and COPE has been covered in section 5.4.

The output of PAM consists mainly of the inputs which are echoed for checking purposes (some of the angles are converted to radians before being printed). The PE values are printed in 70 groups of 60 (6 cloud ceiling altitudes, 10 visibility limits) with each group corresponding to a particular designator-to-target range, time delay, and MUTS factor combination.

A program listing together with sample inputs and outputs is included in in Appendix A_{\bullet}

16.2 PAM Inputs.

The PAM program takes all its inputs in free format (in CDC terminology, it uses list-directed reads). This means that on each card in the following description that takes more than one variable, the values of the variables are punched one after another with commas between successive values. (See sample input in Appendix A).

CARD NO. ____1 CARD SET IMF DESCRIPTION COLUMNS FORMAT UNITS VARIABLE NAME Mission type flag Free IMF IMF = 2 for target of opportunity

16-3

ETH ____CARD SET CARD NO.___2

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
ЕТН	Joules/km ²	Free		ETH is the energy threshold. That is, the amount of energy/ area that must reach the seeker to initiate maneuver.
		16-4		

AOF ____CARD SET CARD NO.___3

ARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
AOF	Degrees	Free		AOF is the angle of fall of the COPPERHEAD round (measured from the horizontal).
		16-5		

TH,PCA CARD SET CARD NO. 4

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
TH	Degrees	Free		Target heading. The angle between the gun-to-target line and the target path when measured counter-clockwise from the gun-target line.
PCA	Degrees	Free		Point of closest approach (deflectibias). This is the distance between the footprint centroid and the clospoint on the target's path to the centroid.
		16-6		

AZDT, V, RHO, ED, TR CARD SET

CARD NO. 5

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
AZDT	Degrees	Free		AZDT is the angle T (that is, the angle between the designator-targ line and gun-target line measured counter-clockwise from the guntarget line.)*
V	Meters/Sec	Free		V is the target velocity.
RH0		Free		RHO is the target's reflectivity.
ED	Millijoules	Free		Designator energy.
TR	Seconds	Free		Nominal respone time (time from D0's call for fire to expected round arrival. It <u>includes</u> time-of-flight in this case.
				*Note: AZDT is the nominal angle T; that is, the angle between the designator-target line and the target-line when TR seconds have passed since DO's call for fire
	:			
		:		
		16-7		

NK, RNG, ACCX, ACCY CARD SET CARD NO. 6

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
NK		Free		NK is the Monte Carlo sample size used in the program.
RNG	Meters	Free		Gun-to-target range (must be the range for which footprints are supplied).
ACCX	Meters	Free		ACCX is the COPPERHEAD total delivery error standard deviation the deflection direction.*
ACCY	Meters	Free		ACCY is the COPPERHEAD total delivery error standard deviation the range direction.*
				*Note: These are the delivery error standard deviations for unguided COPPERHEAD.
		16-8		

IDRMN, IDRMX, IVMX CARD SET CARD NO. 7

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
IDRMN	Km	Free		Minimum designator-to-target range.
IDRMX	Km	Free		Maximum designator-to-target range.
IVMX	Km	Free		Maximum visibility range.
	- -			
	<u> </u> 			
		;		
		16-9		

ΝI	CARD	SET	CARD	NO.	8a
		5	OTIND	110.	- Ou

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
NI(J)		Free		NI(J) is the number of points used to describe the maneuver footprint for the Jth altitude.
				J = 1 for highest altitude 2 for second highest altitude
				6 for lowest altitude
				The six altitudes for which footprints are entered are the six altitudes used for cloud ceiling altitudes in COPE weather data.
				Note that there will be a set of cards 8a, 8b, 8c for each footpring for a total of six such sets in all They must be input in order of ascending J's.
				With current dimensions $NI(J) \le 11$ for all J.
		16-10		

THEMH CARD SET

CARD NO. 8b

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
THEMH(1,J)	degrees	free		THEMH(I,J) is the angle used to represent the Ith point on the boundary of the Jth
THEMH(2,J)	degrees	free		footprint.
THEMH(3,J)	degrees	free		Note that the Jth footprint is represented by a set of points $\{(\rho_i, \theta_i)\}$ in polar coording
THEMH(4,J)	degrees	free		ates, where
THEMH(5,J)	degrees	free		$\rho_{i} = DISMH(I,J).$
THEMH(6,J)	degrees	free		THEMH(1,J) = 0.0
THEMH(7,J)	degrees	firee		THEMH(NÍ(J), J) = 180.0 The angles are measured off the ray in the positive range direction from the centroid
THEMH(8,J)	degrees	free		of the footprint.
THEMH(9,J)	degrees	free		
THEMH(10,J)	degrees	free		
(L,[[])HMƏHT	degrees .	free		Because the footprint is symmetric about the range axis, only one half of it is read in. It is for this reason that the THEMH(I,J) values do not exceed 180 degrees.
				Also note that THEMH(I,J) < THEMH(I+1,J) for I = 1,2,,NI(J) - 1
				If NI(J) < 11, then only NI(J) entries occu on this card rather than the 11 entries shown.
			16-11	
			, , , , ,	

DISMH CARD SET

CARD NO. 8c

VARIABLE NAME	UNITS	FORMAT	COLUMNS	DESCRIPTION
DISMH(1,J)	meters	free		DISMH(I,J) is the distance from the
DISMH(2,J)	meters	free		centroid to the Ith point on the boundary of the Jth footprint.
DISMH(3,J)	meters	free		
DISMH(4,J)	meters	free		
DISMH(5,J)	meters	free		
DISMH(6,J)	meters	free		
DISMH(7,J)	meters	free		
DISMH(8,J)	meters	free		
DISMH(9,J)	meters	free		
DISMH(10,J)	meters	free		
DISMH(11,J)	meters .	free		If NI(J) < 11, then this card will have only NI(J) entries rather than the 11 shown.
	,			
			16-12	

APPENDIX A

LISTING AND SAMPLE CASE OF PAM

APPENDIX A

LISTING AND SAMPLE CASE OF PAM

This appendix contains:

- (1) A listing of the FORTRAN code for the PAM program. In addition to the routines in this listing, PAM also uses the function URAN31 which is included in the COPE listing in Appendix D.
 - (2) Three sets of sample case input for PAM.
- (3) Three sample runstreams for PAM (one corresponding to each set of sample input).
- (4) Sample output created by running PAM with the first set of sample input.

Note: The column numbers included in some of the listings in this appendix are not a part of the program code, the data, or the output, but are provided only for the reader's convenience.

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                                                                                                                                                                                                                                                                                                                    GAHARY HOLDS THE ATTENUATION COFFICIENTS AS A FUNCTION OF RANGE DATA GAMARY 72.6644 1.2058, .7496, .5317, .4059, .3252, .2727, .1334, .2030, .1803, .1618/
                                                                                                                                                          DIMENSION ACQ(6,6), H(6), TOT(6), IMDEX(6,5,2), PE(60,10,7), AMTX(4526), IMX11(2001), THEMHICLL), TOT2(6,10), DISHHILL), THEMHICLL), THEMH
PROGRAM PAM (INPUT, OUTPUT, TAPES-INPUT, TAPE6-OUTPUT, TAPE7, TAPE11)
                              THIS VERSION OF PAM IS CONFIGURED FOR USE AS A PREPROFESSOR FOR CODE. MAKE THESE CHANGES FOR STAND-ALONE PUNS:

1. DELETE CALL TO OPENHS (FIRST EXECUTABLE STATEMENT)

2. DELETE CALL TO PENHAS.

3. DELETE CALLS TO PENHAS.

4. DELETE SUBPRUITINE PENANZ.
                                                                                                                                                                                                                                                                                                                                                                                                            H ARRAY HOLDS ALTITUDES FOR WHICH ACQUISITION IS CHECKED DATA H /1372.0, 014.0, 762.0, 610.0, 457.0, 304.0/
                                                                                                                                                                                                                                                EQUIVALENCE (AMTX(1), TNDEX(1)), (AMTX(61), PE(1))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                            DATA DTS /0.0, 30., 00., 150., 300./
DATA IRN1 /124.567/
DATA IRN1 /124.567/
DATA IRN2 /154.567/
CALL OPENNS (11, INDX11,2001,1)
READ (5,*) INF
IF (IMF.E0.1) WRITE (6,310)
READ (5,320) ETH
WRITE (6,330) ETH
WRITE (6,330) ETH
READ (5,*) ADF
ADF ADF*.01745329252
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DTS ARRAY HOLDS DELAY TIMES PLAYED
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                READ (5,*) TH,PCA
READ (5,*) AZDT,VPHO,ED,TR
WRITE (6,350) AZDT,V,PHO,ED,TR,AOF
WRITE (6,340) TH,PCA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                IF (ED.EQ..20) IDSG=1
IF (ED.EQ..14) IDSG=2
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LISTING A-1 FORTRAN LISTING OF PAM PROGRAM

(PAGE 1 OF 11)

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	PR-PAM 5 PR-PAM 6 DD-DAM 6					PR-PAM 6		PR-PAM 7		PR-PAM 7 PR-PAM 7		PP-PAM 7				PR-PAM B		PR-PAM 8				PR-PAM 9		PR-PAM 9		PR-PAM 98		PR-PAM 101	PP-PAM 103		PK-PAM 105		PR-PAM 108	388888888888888888888888888888888888888
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READ (5,*) HK, RHG, ACCX, ACCY GTR=RHG/1000, WRITE (6,360) HK, PHG, ACCX, ACCY	READ (5,*) IORMH,IORMX,VVMX WRITE (6,370) IORMN,IDRMX,IVMX DO 110 1=1.6	RED (5) * NI(3)	NIJ=NI(J) WRITE (6,390) J,NI(J)	READ (5,*) (THENH(I,J),I=1,NIJ) DEAD (5,*) (DISHUTI,I),I=1,NII)	WRITE (6,380) (THENH(I,J), I=1, NIJ)	WRITE (6,400) (DISMH(I,U),I=1,NIJ) DD 100 1=1,NIJ		100 CONTINUE		WRITE (6,410) INCNDE,IDCNDE WRITE (6,420) V,TE,ED,RMO	ω (DO 240 IDR=IPRMIJIPRMX	ND=FLOATIDK) DD 230 IV=1,IVMX	DN 220 IDELT=1,5	U = DIS(IDELI)	DU 210 IMTS=1,2	C	If (IMF.Eq.1) TLOC=SQRT((2500.+1.5*((TR+DT)**2.)))	-		PCAX=PCA*CUS(11) PCAY=PCA*SIN(TH)	C CONPUTE TARGET COORDINATES FOR GIVEN DELAY/VELOCITY	BIASY=PCAY-(CDS(TH)*V*DI)		C BEGIN MONTE CARLO LOOP RY SAMPLING TLF DO 150 K=1,NK	CALL MRAN31 (SXI, SX2, IPN1)	T[OCY=SX]*T[JC	C SUM RANDOM ERROR TO BIAS FRROR	TLEX=TLOCX+BIASX	LETT LUCT + BIAST	CALL	BIPY=SX1*ACCY BIPY=C×2*Accv	000000000111111111111122222222222222233333334444444555555555666666667777777788888888899

LISTING A-1 FORTRAN LISTING OF PAM PROGRAM - CONT'D

(PAGE 2 OF 11)

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160 TUT(IC)=TUT(IC)+ACQ(IC,IA)
WPITE(6,102)(H(IC))-1C=1,6),(H(IA),(ACQ(IC,IA),IC=1,6),IA=1,6)
WRITE(6,100)(TUT(IC),IC=1,6)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  INDEX RESULTS FOR COPE INTERFACE AND FOR TAPES OUTPUT
                                                                                                                                                                                                                                                                 HS=(H(IA)*3.28)
RS=SQRT(KINT-TLEX)**2.+(YINT-TLEY)**2.+H(IA)**2.)
RS=RS/1000.0
                                                                                                                                                                                                                                                                                                                                TS=EXP((-GAM*RS)*(1.-EXP(-.00025*HS))/(.00025*HS))
TFACT=COS(ANGSUM)
ES=(ED*TD*TS*RHO*TFACT)/(P1*PS*RS)
                                                                                                                                                                                                                                                                                                                                                                                                                                            MANUEVERABILITY FOOTPRINT DISTANCE COMPAPISON
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ACCUMULATE PECULTS OVER CFILING AND ALTITUDE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              TANG=ABS((TLEY-BIPY)/(TLEX-RIPX))
BCTA=ATAN(TANG)
BFTA=1.5708-BETA
IF (TLEY.LT.8IPY) BETA=3.1416-BFTA
DIST=SORT((TLEX-BIPX)**2.+(TLEY-BIPY)**2.)
NIJ=NI(IA)
DO 120 J=1.NIJ
THENHI(J)=THENH(J,IA)
DISMHI(J)=DISMH(J,IA)
OSMHI(J)=DISMH(J,IA)
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IF (DIST, GT, MDIS) GU TU 130
ACQ(IC, IA) = ACQ(IC, IA) + 1.0
GU TO 140
130 CNVINUE
140 CONVINUE
150 CNVINUE
AQUISITION VOLUME ENERGY COMPARISON
                                                                                                                                                                                            ANGSUM=(AZDT*,01745320252)+ALPHA
GAH=GAMARY(IV)
TD=EXP(-GAM*RD)
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INDEX(II,IDELT,IMTS)+JPE
                                          DD 140 IC=1,6
DD 130 IA=IC,6
YINT=-H(IA)*CDT(ANF)+BIPY
                                                                                                                                                                                                                                                                                                                                                                                                (ETH.6T.ES) 6n rn 130
                                                                                                                                                                             ALPHA=ATAN2(X,Y)
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                                                                                                                                   X=(TLEX-XINT)
Y=(TLEY-YINT)
                                                                                                            XINT=BIPX
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LISTING A-1 FORTRAN LISTING OF PAM PROGRAM - CONT'D

(PAGE 3 OF 11)

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1 TR= ,F7.2,6H ADF= ,F5.2)
360 FORMAT (1H ,5H DR= ,16,6H PHG= ,F10.1,6H ACCX=,F6.2,8H ACCY = ,F6.039940
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310 FORMAT (FIL2.8)
320 FORMAT (FIL2.8)
330 FORMAT (IH ,4HETH=,FIL2.8)
340 FORMAT (IH ,24H TARGET HEADING ANGLE = ,F5.2,13H PT CLS APF= ,F7.2039900
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370 FORMAT (1H ,6HIPRHH=,14,8H IDPMX=,14,7H IVMX=,14)
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27 (K,E0,2),AND,(J,GT,1)) GN TN 250
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WRITE (IUNIT,450) ((IMDEX(1,3,K),K=1,2),J=1,5)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           * *
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    (IUNIT,460) ((PE(I,J,K),K=1,7),J=1,10)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          CALL WRITHS (11,ANTX,4260,ICCNDE,-1,0)
CALL CLOSMS (11)
STOP 'IN PAM: NORMAL PROGPAM TFPMINATION
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         * * * FORMAT STATEMENTS
0 PE(JPE,IV,IDR)=TOT(II)

00 180 I=10.6

IPE=10*(IDE_1)*2*(IDELT-1)+IMTS

LKUP(IDR,IDELT,IMTS)=IPF

0 PEHG(IPF,IV,II)=TOT(II)

00 190 IC=10.6
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    IF (IUNIT.EQ.7) GO TO 290 IUNIT=7
                                                                                                             TOT2(IC, IV) = TOT(IC)
CONTINUE
                                                                                                                                                   DN 200 IC=1,6
DO 200 IA=1,6
ACQ(IC,IA)=0.
TOT(IC)=0.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   280 I=1,60
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             260
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DD 270 I
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(PAGE 4 OF 11)

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FORTRAN LISTING OF PAM PROGRAM - CONT'D

LISTING A-1

PR-PAH 218 PR-PAH 219 PR-PAH 220 PR-PAH 222 PR-PAH 223 PR-PAH 223 PR-PAH 226 PR-PAH 226 PR-PAH 226 380 FORMAT (1H , 12HTHE WH(I, J) = /(12F10.1))
390 FORMAT (1H , 12HTHE WH(I, J) = /14,0H MI(J) = ,14)
400 FORMAT (1H , 12H DISMH(I, J) = /(11F10.1))
410 FORMAT (1H , 12H DISMH(I, J) = /(11F10.1))
420 FORMAT (1H , 10H VELNCITY = /(12H NECP THE + F7.2) 18H DESIGNO40010
1ATOR POWER = /(1 , 2) 15H RELECTIVITY = /(1 , 2)
430 FORMAT (1H , 1/) 1H , 18HDESIGHATION PANGE = /(1 , 13H DELTA TIME = /(1 , 2)
440 FORMAT (6F10.5)
440 FORMAT (2110)
640050
640 FORMAT (2110)
640050 04 00 60 04 00 70 04 00 80

COLUMN NUMBERS (READ VERTICALLY)

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(PAGE 5 OF 11)

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SR-DVDIN40
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SR-DVDIN42
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               040620
                                                                                                                      (X-2,*XT(1)+XT(2)) 240,240,120
(X-2,*XT(HP)+XT(HP-1)) 130,130,240
(HP.LT,10) 6H TH 150
SUBROUTINE DVDINT (X,FX,XT,FT,NP,NP)
DIMENSION XT(NP), FT(NP), T(L6)
N=ND
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  \Gamma(1) = (\Gamma(1+1) + \Gamma(1)) / (XT(N8) + XT(N5))
                                                                                    IF (XT(1)-XT(2)) 110,330,260
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         240 WRITE (6,340) X,XT(1),XT(NP)
                                                                                                                                                                                            (XT(H6),LT.X) H4=N6
(N5,GT.1) GD TD 140
(X-XT(N4)) 180,160,160
(H4-N3) 170,180,170
                                                                        (NP-N) 250,100,100
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        Gn TO (210,220), JH
UN=UN*(X-XT(H6))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          GH TH 230
UN=UN*(X-XT(H7))
                                                                                                                                                                                                                                                                                                                                                                                                           UN=1.0
DO 230 J=1,N2
N5=N4-N1
                                                                                                                                                                                                                                                                                                                                                                                                                                                      DD 200 I=1,N3
N8=N5+J
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    TR=TE+UN+T(L)
                                                                                                                                                                                                                                                                                               DO 190 I=1,N
T(1) = FT(H5)
                                               N2=N/2
N3=NP-N2+1
                                  N1=(N-1)/2
                                                                                                                                                                                                                                                                                                                       N5=N5+1
L=(N+1)/2
                                                                                                                                                                                                                                                           TO 150
                                                                                                                                                                                                                                                                                     45=N4-N1
                                                                                                                                                           N5=NP-H
N5=N5/2
                                                                                                                                                                                                                        150 IF (X-XT
160 IF (N4-N
170 N4=N4+1
                                                                                                                                                                                                                                                                                                                                               TR=T (L)
N6=N4
                                                                                                                                                                                                                                                           60 TU 1
180 N4=N4-1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               N7=N7+1
                                                                                                                                                                                                                                                                                                                                                                       N7=N4+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              N5=N5+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                N6=N6-1
                                                                                                                                                                                                                                                                                                                                                                                              12=11-1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              RETURN
                                                                                                                                                                                                                                                                                                                                                                                                                                              N3=N-J
                                                                                                                                                                                                                                                                                                                                                                                   JU=1
                                                                                                            110
                                                                                                                                   120
                                                                                                                                                                         140
                                                                                                                                                                                                                                                                                                                       100
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LISTING A-1 FORTRAN LISTING OF PAM PROGRAM - CONT'D

(PAGE 6 OF 11)

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                                                                                                                                                                                                                                                                                                                                                                                              340 FORMAT (23H ARG. NOT IN TABLE X= ,E14.7,9H XT(1)= ,E14.7,10H 1(NP)= ,E14.72.5.4HVDINT)
250 FORMAT (22H TABLE TOO SMALL NP=,15,6H ND=,15,2X,6HDVDINT)
360 FORMAT (23H CHYSTAIT TARLE XT(1)= ,E14.7,2X,6HDVDINT)
                                                                                                                                                                                                                                                                                                                                                             STATEMENTS ***
                                                                                                   260 JF (X-2.*XT(1)+XT(2)) 270,240,240
270 JF (X-2.*XT(NP)+XT(NF-1)) 240,280,280
280 JF (HP.LT.10) 60 TG 300
N5-NP-N
290 N5-N5/2
                                                                                                                                                                                                       IF (XT(N6),GT,X) H4=N6
IF (H5,GT,1) GD TN 290
IF (X-XT(N4)) 310,310,180
IF (N4-N3) 320,180,320
                                                                                                                                                                                                                                                                                              GD TD 300
330 WEITE (6,360) XT(1)
                                                       STOP
250 WRITE (6,350) HP, HD
                                                                                                                                                                                                                                                                                                                                                                 * * * FORMAT
                                                                                                                                                                                                                                                                                320 N4=N4+1
                                                                                                                                                                                                                                             300
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LISTING A-1 FORTRAN LISTING OF PAM PROGRAM - CONT'D

(PAGE 7 OF 11)

	040920 SR-NRAN313					
SUBROUTINE HRAHIST (X1, X2, I)	X3=SORT(-2.0*ALOG(URAN31(I)))	X4=6.2831853072*(PAH31(I)	X = X 3 + X 4) X 4) X 5 + X 5 + X 5 + X 5 + X 6 + X	XI=X3*C(1) { X4 }	RE TURN	ETID

LISTING A-1 FORTRAN LISTING OF PAM PROGRAM - CONT'D

(PAGE 8 OF 11)

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7888 9012
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2233
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SR-PENAM22 SR-PENAM23 SP-PENAM24	CM+XVALUE2 SR-PENAM26 SR-PENAM27	DT+XVALUE2 DT+XVALUE3 DT+XVA(1F4	DT+XVALUE5 DT+XVALUE6	DT+XVALUE7 DT+XVALUE8	DT+XVALUE9 DT+XVALUIO	DIXXALUII	DT+XVALU12	D1+XVALU13 D1+XVALU14	DT+XVALUIS	DT+XVALU16	DI+XVALUI8	DT+XVALU19	D1 + X V A E U Z U DT + X V A L U Z 1	DT+XVALU22	DT+XVALU23	DI + XVALU25	DT+XVALU26	DT+XVALU27	DI+XVALU29	DT+XVALU30	DT+XVALU31	DI+XVALU33	DI+XVALU34	01+XVALU35 bt + xval 1134	DT+XVALU37	DT+XVALU38 <p-pfnam29< th=""><th>SR-PENAM10</th><th>SR-PENAM11</th><th>SR-PENAM13</th><th>SR-PENAM14</th><th>SP-PENAM15</th><th>SP-PENALO SP-PENAM17</th><th>SP-PENAM18</th><th>SR-PENAM19</th><th>78888888889 COLUMN NUMBERS</th></p-pfnam29<>	SR-PENAM10	SR-PENAM11	SR-PENAM13	SR-PENAM14	SP-PENAM15	SP-PENALO SP-PENAM17	SP-PENAM18	SR-PENAM19	78888888889 COLUMN NUMBERS
04 09 9 0 04 10 00 04 10 10 10	001100 041030 041040	001610 001620 001630	001640	001660 001670	001680	001200	001710	001720	001740	001750	001170	001780	001790	001810	001820	001840	001850	001860	001880	001890	001900	001910	001930	001040	001320	001970	041070	041080	041100	041110	041120	041130	041150	041160	7777777
PENAM2 (TR, IDT, VEL, GTR, REFL, ANGLET, DEFB, TGTHD, SKSEN,		Lnck * * * *	, J±1,9) / E TIMES					3 3*0°9		10.,	9.9 D.9	4*0*3	4*8.,	90., 120., 2*0.,	4., 5., 2*8.,	200. * 3*0. *			60.5 340.5		FULLOWING CARD CONTAINS FALSE SEEKER SENSITIVITY VALUES TO	IN THE PROGRAM LISTING. Sed when poinning in a secure	ENVIRONMENT. RUNS DONE WITH THESE FALSE VALUES ARE FOR EXAMPLE	4	/x,, 340,, 4., 348,/										0000000011111111122222222233333333344444444555555566666666677777778888888888
VEL, GTR, P.	(24	COMMON B	P) K=1,2)	!	9	17*0**		8.9			3.,	*30, 4	3., 44	60.9		1001			30.,		HS FALSE	D NUMBERS BE DESTON	ITH THESE	1	3										3333333334
SUBROUTINE PENAM2 (TR, IDT, V L IDCODE)	COMMON /XVALUE/ XVALUE(8,9,2 DIMENSION AVALUE(9), NP(9)	* * * * * FILL IN XVALUE COMMON BLOCK	DATA (((XVALUE(I,J,K),I=1,R),K=1,2),J=1,9) DIMMY SLOTS FOR HOMINAL RESPONSE TIMES	1 8*0.,	DESIGNATOR TYPE	2.5	TARGET VELOCITIES	3., 5.,	C U., U., I., C., C., C., C., C., C., C., C., C., C		2 0.9 1.9 2.9 been ectivities		2 0.9 1., 2.,	ANGLES 1 1 0., 25., 30.,	1., 2.,		2 0.5 1.5 2.5	TARGET HEADINGS	., -30., 0.,	SFFKFP SENSITI	THE				1 24.9 36.9 48.9		AV AT 11F (1) = TP	AVALUE(2) = IDT	AVALUE (3)=VEL	AVALUE(5)=REFL	AVALUE (6)=ANGLET	AVAL UF (7) = DE FB	AVALUE (0) = 16100	AVALUE (97 = 515) C.N.	3000011111111111222233333
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LISTING A-1 FORTRAN LISTING OF PAM PROGRAM - CONT'D (PAGE 9 OF 11)

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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      041620
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                041660
                                                                                                                                                                 IF (TP.LE.O.O.RP.TP.GE.909.5) STOP ' IN PENAM2: ERROR NUMBER 3 '
                                                                                                                                                                                                                                                                                                                                                                                                                             IF (ABS(FLOAT(NP(J))-XVALUE(I,J,2)).GT..0001) GD TO 150
AVALUE(J)=XVALUE(I,J,1)
                            DO 110 J=2,9
DO 100 I=1,n
If (ABS(AVALUE(J)-XVALUF(I,J,1)),GT..0001) GO TO 100
NP(J)=XVALUE(I,J,2)+.5
GO TO 110
                                                                                                                       DO 120 J=2,0
IF (NP(J).GE.8) STOP • IN PFHAM2: EPPOR NUMBER 2
120 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                       4
                                                                                                                                                                                                                                                                                                                                                                                                                                                            STMP * IN PENAM2 (PEIDHT): EPROP NUMBER
CONTINUE
                                                                                           =
                                                                                       STOP ' IN PENANZ: ERROR NUMBER
110 CONTINUE
                                                                                                                                                                                                                                                                                                              DECODE (10,180, IPCODE) ACODE
                                                                                                                                                                                                                             ENCORE (10,170,IPCORE) NCORE
                                                                                                                                                                                                                                                                                                                                 Dn 140 J=2,9
MP(11-J)=NUD(NCODE,8)
NCODE=NCODE/8
CMTINUE
                                                                                                                                                                                              DO 130 J=2,9
NCODE=8*NCODE+NP(J)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           VEL=AVALUE(3)
GTR=AVALUE(4)
RFFL=AVALUE(5)
AMGLET=AVALUE(6)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   AVALUE (1) = NCOPE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     DEFE=AVALUF (7)
                                                                                                                                                                            NCODE= TR+.50
                                                                                                                                                                                                                                                                                          ENTRY PEIDNT
                                                                                                                                                                                                                                                                                                                                                                                                        DO 160 J=2,9
DO 150 I=1,8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   IDT = AVALUE (2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        TR=AVALUE(1)
                                                                                                                                                                                                                                                                                                                                                                                     NP (1)=NC DDE
                                                                                                                                                                                                                                                                                                                                                                                                                                                          CONTINUE
                                                                               100 CONTINUE
                                                                                                                                                                                                                                                 PETUPN
                                                                                                                                                                                                                                                                      *
                                                                                                                                                                                                         130
                                                                                                                                                                                                                                                                                                                                                                 140
                                                                                                                                                                                                                                                                                                                                                                                                                                                            150
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              160
```

LISTING A-1 FORTRAN LISTING OF PAM PROGRAM - CONT'D (PAGE 10 OF 11)

00000000111111111122222222233333334444444444	7777788888888889 COLUMN NUMBERS 5678901234567890 (READ VERTICALLY)
TGTHD=AVALUE(8) SKSEN=AVALUE(9) 041730 SP-	1710 SR-PENAM74 1720 SR-PENAM75 1730 SR-PENAM76
C 170 FORMAT (4HPEOO,R6) 041790 SR- 180 FORMAT (4X,P6) 041810 SR- FND FND	1790 SR-PENAMB2 1800 SR-PENAMB3 1810 SR-PENAM84
00000000011111111122222222223333334444444444	7777788888888888 COLUMN NUMBERS 5678901234567890 (READ VERTICALLY)

LISTING A-1 FORTRAN LISTING OF PAM PROGRAM - CONT'D (PAGE 11 OF 11)

1000060
20.0
0.00.0.0
25.55.10.2.106.2.106.
11.75.10
0.0.20..75.50..700..700..135..180.
2000..1800..1600..1400..1200..1000..800..600.
2000..1800..1600..1400..1200..1000..800..600.
2000..1800..1600..1400..1200..1000..800..600.
2000..1800..1600..1200..1200..1000..800..600.
1500..1400..1300..1200..1200..1100..1000..800..600.
1500..1400..1300..1200..1200..1100..1000..800..600.
1000..20..30..45..60..90..135..180.
1000..900..800..700..900..135..180.

LISTING A-2A SAMPLE INPUT SET 1 FOR PAM

LISTING A-2B SAMPLE INPUT SET 2 FOR PAM

LISTING A-2C SAMPLE INPUT SET 3 FOR PAM

JOB CARD. CHANGE THIS CARD TO CONFORN TO INSTALLATION USAGE.

ACCOUNT CARD. CHANGE THIS CARD TO COMFORN TO INSTALLATION USAGE.

COMMENT. THIS RUNSFREAM IS USED WITH THE FIRST RUN OF THE PAM PROCRAM;
COMMENT. THAT IS, THE RUN IN WHICH TAPELI IS TIRST CREATED.

COMMENT. THE MEXT STATEMENT DECLARGES TAPES TO BE A FILE OF RECORD

COMMENT. SA FILE FORM THE "FRONT FND" COMPUTER WHICH USES A DIFFERENT

COMMENT. JOB IS TO BE RUN.

FILE, TAPES, TSTATEMENT STATEMENT FROM THE PAM INPUT FROM THE

COMMENT. JOB IS TATEMENT OF THE THATA.

COMMENT. THE NEXT STATEMENT OF THE MACHINE LANGUAGE ("OBJECT

COMMENT. THE NEXT STATEMENT ATTACHES THE MACHINE

COMMENT. CODE") CREATED BY RUNHING THE PAM SOURCE CODE THROUGH THE

COMMENT. CODE") CREATED BY RUNHING THE PAM SOURCE CODE THROUGH THE

COMMENT. CODE") CREATED BY RUNHING THE PAM SOURCE CODE THROUGH THE

COMMENT. FOR THE FILE WHOSE LOCAL NAME IS TAPELI.

REQUESTINATELLA FOR TATACHES THE PAM SOURCE CODE THROUGH THE

COMMENT. THE NEXT STATEMENT RESERVES SPACE ON A PERMANENT FILE DEVICE

COMMENT. THE NEXT STATEMENT LOADS AND EXECUTES THE PAM PROGRAM USING

COMMENT. THE NEXT STATEMENT CATALOGS TAPELL AS A PERMANENT FILE.

COMMENT. THE NEXT STATEMENT CATALOGS TAPELL AS A PERMANENT FILE.

COMMENT. THE NEXT STATEMENT CATALOGS TAPELL AS A PERMANENT FILE.

COMMENT. THE NEXT STATEMENT CATALOGS TAPELL AS A PERMANENT FILE.

COMMENT. THE NEXT STATEMENT CATALOGS TAPELL AS A PERMANENT FILE.

LISTING A-3A SAMPLE RUNSTREAM 1 FOR PAM

LISTING A-3B SAMPLE RUNSTREAM 2 FOR PAM

JUB CARD. CHANGE THIS CARD TO CONFORM TO INSTALLATION USAGE.
ACCOUNT CARD. CHANGE THIS CARD TO CONFORM TO INSTALLATION USAGE.
ACCOUNT CARD. CHANGE THIS CARD TO CONFORM TO INSTALLATION USAGE.
COMMENT. THE RUNSTREAM IS USED WITH RUNS OF THE PAM PPOGRAM MADE AFTED COMMENT. THE LATE IS BEEN CREATED.
COMMENT. TYPE Z WITH 80 CHARACTER LINES. THIS IS REQUIRED SINCE TAPES COMMENT. TYPE Z WITH 80 CHARACTER LINES. THIS IS REQUIRED SINCE TAPES COMMENT. TO A FILE FRMIT THE "FROMT THE "BACK FND" COMPUTER WHICH THIS COMMENT. THE NEXT STATEMENT OFF WHICH THIS COMMENT. THE NEXT STATEMENT BAND FROM THE "BACK FND" COMPUTER ON WHICH THIS COMMENT. "FRINIT END" COMPUTER AND PUTS IT IN THE LACAL FILE TAPES. PAMSAPHEINDTS JID-SANDMEYER, STEMFA.
COMMENT. "FRINIT END" COMPUTER AND PUTS IT IN THE LACAL FILE TAPES. COMMENT. THE NEXT STATEMENT ATTACHES THE MACHING THE PAM INPUT RAPES. COMMENT. FORTRAN COMPLIER IN A PREVIOUS JOR.
COMMENT. FORTRAN COMPLIER IN A PREVIOUS JOR.
COMMENT. DATA BASE" FILE! WHICH WILL BE MODIFIED ("EXTENDED") BY THIS COMMENT. THE HEXT STATEMENT ATTACHES THE PAM PROGRAM USING COMMENT. BE EXTENDED.
ATTACH, JORD FARM THE HULTI-READ OPTION IS TURNED JFF SO THAT THE FILE CAN COMMENT. THE NEXT STATEMENT LOADS AND FXECUTES THE PAM PROGRAM USING COMMENT. THE NEXT STATEMENT EXTENDED.
ATTACH, JORD FARD STATEMENT EXTENDE TAPE ILLE NAME TAPEIL. CHANGES HADE BY THIS ROUND HERE COMMENT. THE NEXT STATEMENT EXTENDS TAPELL. THIS NEADL THE THAT WAS ATTACHED UNDER LOCAL FILE NAME TAPEIL.

LISTING A-3C SAMPLE RUNSTREAM 3 FOR PAM

COMMENT. END OF JOB.

1	I DP: FIX =	. <	IVMAR 10				
J= 1 4	41(7)=	œ					
0.0 0.0	20.0	30.0	45.0	0.09	0.00	135.0	180.0
2000.0	1800.0	1600.0	1400.0	1200.0	1000.0	800.0	0.009
J= 2 4	4I(7)*	8					
0.0 0.0 0.0	20.0	30.0	0.34	60.0	0.00	135.0	180.0
2000.0	1800.0	1600.0	1400.0	1200.0	1000.0	800.0	0.009
J= 3 N	NI(J)=	€					
0.0 0.0 0.15NH (1)	20.0	30.0	45.0	0.09	0.06	135.0	180.0
1500.0	1400.0	1300.0	1200.0	1100.0	1000.0	800.0	0.009
J= 4 N	*(f)IN	&					
0.0 0.0 DISMH(1.1)=	20.0	30.0	45.0	0.09	90.0	135.0	180.0
1500.0	1400.0	1300.0	1200.0	1100.0	1000.0	800.0	0.009
J= 5 4] THEMH(J•J)=	4I(J)=	æ					
0.0 0.15MH(I.1)=	20.0	30.0	45.0	0.09	۵۰۵۰	135.0	180.0
1000.0	0.006	800.0	0.007	0.009	500.0	400.0	300.0
J= 6 NI THFMH(1, 1)=	HI (J) =	60					
0.0 0.15MH(I1)=	20.0	30.0	45.0	0.09	0.00	135.0	180.0
1000.0 IDCONF = PF0 VFLOCITY=5.0	900.0 0A)AAJS 0 MEAN R	800.0 IDCODE: 2 ESP TIME:	0 900.0 800.0 500.0 500.0 500.0 600.0 87.00 1223 7*5.00 HEAN RESP TIME* 106.00 DESIGNATOR P	600.0 01011223 IGNATOP PE	500.0	1000.0 900.0 800.0 700.0 600.0 500.0 400.0 1000.0 500.0 400.0 1000.0 = PF00A1AAJS IDC 0DE= 2005333015201011223 VELUCITY=5.00 HFAN RESP TIME= 106.00 DESIGNATIP POWEP= .20 PEEL FTIVITY-	300.0
DESTRUCTION B	2 3 3 W C C	+			•		
1.00000 1	. 29000 1.00000	1 PELTA .29000 1.00000	TIME = 0.0000 .29000 1.00000	.29000 .29000 .91000	SEVERAL TARGETS . 29000	ARGETS = 1	
	1.00000	1.00000	1,00000	RROOO	00000		

LISTING A-4 SAMPLE OUTPUT FROM PAM (PAGE 1 OF 11)

80 N
OL UMN
00000000000000000000000000000000000000

				DESIGNATION RANGE 1 DELTA TIME=150.0000 DNE DP SFVEPAL TARGETS * 1 .06000 .06000 .06000 .06000 .06000 .06000 .06000 .38000 .38000 .38000 .15000 .15000 .15000 .36000 .36000 .40000 .10000 .10000 .00000 .42000 .42000 .42000 .40000 .12000 .12000 .12000 .12000
89000 89000 88000 99000 92000	SEVERAL TAPGETS = 2 .32000 .93000 .93000 .92000 .91000 .91000 .91000 .91000	SEVEPAL TARGETS = 1	SEVERAL TARGETS = 1 .19000 .29000 .27000 .32000 .28000 .28000 .27000 .27000	SFVEPAL TARGETS * 1 .06000 .16000 .15000 .00000 .00000
00 . 89000 . 00 . 00 . 00 . 00 . 00 . 00	32000 32000	.4000 .4000 .6000 .7100 .7200 .7200 .7200 .7200 .7400	.1900 .1900 .2900 .27000 .32000 .32000 .28000 .28000 .27000 .27000 .27000 .27000 .27000 .27000	THE-150.0000 DNE DP SF .06000 .06000 .38000 .15000 .40000 .09000 .42000 .09000
1,00000 1,00000 99000 99000 1,00000 1,00000 99000 99000	1 DELTA TIME	1 DELTA TIME= 3040000 -40000 -97000 -97000 -98000 -98000 -97000 -95000 -97000 -95000 -97000 -95000 -97000 -97000 -97000 -97000 -97000 -97000	1 DELTA TIME= 90. 19000	1 DELTA TIME=1: .06000 .38000 .36000 .40000 .42000 .40000
1.00000 .99000 1.00000 1.00000	DESIGNATION RANGE = .32000 .32000 .99000 .99000 .99000 .99000 1.00000 0.000000	0FSIGMATION RANGE - 40000 .97000 .97000 .97000 .96000 .96000 .96000 .97000 .97000 .97000 .97000 .97000 .97000 .98000 .98000 .98000 .98000 .98000	0FSIGNATION RANGE= .19000 .19000 .69000 .69000 .74000 .74000 .68000 .68000 .70000 .70000 .70000 .71000 .72000 .72000	DESIGNATION RANGE - 06000 . 06000 . 38000 . 36000 . 40000 . 42000 . 42000 . 40000

LISTING A-4 SAMPLE OUTPUT FROM PAM (PAGE 2 OF 11)

	1		8	7
	6ETS =	GETS *	eeTs =	6ETS =
.14000 .04000 .07000	SEVERAL TAP .01000 0.00000 .02000 0.00000 0.00000 0.0000 0.0000 0.0000	SEVERAL TARGETS 0.00000 .80000 .87000 .88000 .89000 .88000 .93000 .94000	SEVERAL TARGETS 0.00000 .80000 .91000 .93000 .91000 .94000 .91000	SFVEPAL TAPGETS 0.00000 .77000 .74000 .65000 .65000 .73000
.14000 .04000 .07000	000 DNE DR 01000 0.00000 0.00000 0.00000 0.0000 0.0000 0.0000 0.0000	0.0000 UNE DP 0.00000 0.00000 0.00 .89000 0.00 .88000 0.00 .88000 0.00 .86000 0.00 .90000	0.0000 DHE OR 0.00000 0.00 .91000 0.00 .91000 0.00 .91000 0.00 .91000 0.00 .91000 0.00 .91000 0.00 .91000	
.35000 .35000 .35000	TIME 300,0000 UNE DR -01000 .01000 -05000 .02000 -01000 .01000 -01000 0.00000 -01000 0.00000 -05000 .01000 -05000 .02000 -05000 .02000	TIME 0.00 0.00000 1.00000 1.00000 1.00000 0.99000 0.98000 1.00000	TIME 0.00000 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	TIME = 30.0000 DNF DR 0.00000 0.00000 91000 .77000 95000 .74000 99000 .65000 99000 .65000 97000 .73000
.34000 .42000 .36000	1 DELTA 01000 05000 00000 02000 02000 05000	2 DELTA 0.00000 1.00000 1.00000 1.00000 99000 99000 98000 1.00000	2 DELTA 1 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	2 DELTA 1 0.00000 91000 95000 95000 97000 97000
.34000 .42000 .36000	. DANGE 01000 . 05000 . 02000 . 02000 . 05000 . 05000 . 05000 . 05000 . 05000 . 05000 . 05000 . 05000	RANGF = 0.00000 92000 1.00000 1.00000 1.00000 99000 98000 1.000000 1.0000000 1.000000 1.000000 1.000000 1.0000000 1.0000000 1.0000000 1.000000000 1.0000000000	PANGE = 0.00000 97000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	RANGE - 0.00000 . 91000 . 95000 . 95000 . 95000 . 97000 . 97000 . 97000 . 99000
.34000 .42000 .36000	DESIGNATION 01000 05000 01000 01000 02000 05000 06000	DESIGNATION 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	DESIGNATION 0.0000 1.00000 1.00000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000	DE SIGHATION 0.00000 .91000 .95000 .95000 .97000

SAMPLE OUTPUT FROM PAM (PAGE 3 OF 11) LISTING A-4

	1			1 COLUMN NOS.	00,000,000,000,000,000,000,000,000,000
	TAPGETS =	SEVERAL TARGETS = 0.00000 10000 11000 07000 07000 09000 12000 12000 06000	SEVERAL TAPGETS * 0.00000 0.00000 0.02000 0.02000 0.02000 0.02000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000	SEVERAL TARGETS = 0.00000)000000000000 55666666666
.57000	SEVEPAL TAPGETS 0.00000 2.0000 2.20000 3.2000 2.29000 2.29000 2.29000 2.29000 3.3000 3.3000 3.3000			SEVERAL 0.00000 950000 95000 93000 93000 95000 95000	000000000000000000000000000000000000000
.57000	000 DNE OP. 200000 200000 20000 32000 32000 34000 34000	ME=150,0000 UNE UR 0,00000 0,00000 21000 0,00000 34000 11000 41000 11000 37000 0,0000 31000 12000 31000 12000	1ME = 300,0000 DNE DR 0,00000 0,00000 0,0000 0,00000 11000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,00000 0,0000 0,00000	0.0000 DNE TR 000 0.00000 0.0000 0.0000 0.000 0.93000 0.00 0.82000 0.00 0.85000 0.00 0.87000	00000000000
.93000	1.11E - 00.0000 DHE OP 0.00000 0.00000 0.55000 25000 0.66000 32000 0.75000 29000 0.75000 29000 0.75000 28000 0.74000 25000 0.74000 34000	1ME=150.00 0.00000 21000 31000 41000 41000 31000 31000	TIME = 300.00 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	TIME 0.0 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	000000000000000000000000000000000000000
. 93000	2 DELTA T 50.00000 .56000 .75000 .66000 .78000 .78000 .78000 .78000 .78000 .74000 .68000 .68000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000 .88000	2 DELTA 1 0.00000 21000 38000 43000 41000 37000 31000	2 DELTA 0.00000 0.04000 0.05000 0.06000 0.08000 0.07000 0.05000	3 DELTA 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	00000000000
.93000	ANDE = 0.00000 .50000 .50000 .75000 .78000 .73000 .74000	RANGE = 0.00000 .21000 .39000 .39000 .41000 .41000 .31000	RANGE = 0.00000 .04000 .05000 .05000 .06000 .06000 .07000 .05000 .05000 .05000 .05000 .01000 .01000	1 RANGF = 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	000000000
00096.	DESIGNATION 0.00000 .56000 .65000 .75000 .66000 .78000 .78000 .74000 .68000	DF SIGNATION 0.00000 .21000 .39000 .43000 .41000 .31000 .31000	DESIGNATION 0.00000 0.00000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000	DESIGNATION 0.00000 1.00000 1.00000 .99000 1.00000 1.00000 1.00000 1.00000	00000000000

LISTING A-4 SAMPLE OUTPUT FROM PAM

(PAGE 4 0F 11)

N	-			
10	•	-	7	П
SEVERAL TARGETS = 0.00000	SEVEPAL TAPGETS = 0.00000	SEVEPAL TARGETS = 0.00000	SEVEPAL TARGETS = 0.00000	SEVERAL TARGETS =
0.0000 DNE DR 00 0.00000 00 .47000 00 .92000 00 .94000 00 .94000 00 .92000 00 .93000	0000 DNE NP 0.00000 .4700 .6700 .6700 .7100 .7100 .6700	90,0000 UNE UR 5 0000 0,00000 26000 32000 000 32000 000 34000 000 26000 000 26000 000 26000	UNE UR 00000 07000 08000 10000 18000 05000 16000	DELTA TIME=300.0000 DNE DR S
11ME =	11ME 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	11ME - 26 00 00 00 00 00 00 00 00 00 00 00 00 00	71ME-150,0000 0,00000 0,00000 3,0000 1,1000 1,1000 1,4000 1,4000 1,41000	TIME=300.0
3 DELTA 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	3 DELTA 0.00000 .47000 .95000 .95000 .95000 .95000 .95000	3 DELTA 0.00000 2.0000 73000 77000 68000 65000 66000	3 DELTA 0.00000 30000 37000 35000 41000 42000 42000 440000	3 DELTA
1 RANGE = 0.00000	1 PANGE - 0.00000 . 47000 . 95000 . 95000 . 95000 . 95000 . 95000 . 95000 . 95000 . 95000 . 98	RANGE = 0.00000	PANGE = 0.00000 .07000 .37000 .31000 .41000 .46000 .46000 .46000 .41000 .41000	RANGE
DF SIGHATION 0.00000 1.47000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	0.51GHATINH 0.0000 0.0000 0.9500 0.9500 0.9500 0.9500 0.9500 0.9500 0.9500	DFSIGHATION 0.0000 0.0000 0.75000 0.75000 0.75000 0.75000 0.65000 0.65000 0.65000 0.65000	DESICHATION 0.00000 3.00000 3.30000 3.35000 4.1000 4.2000 4.2000 4.1000	DFSIGNATION

LISTING A-4

SAMPLE OUTPUT FROM PAM (PAGE 5 0F 11)

				DESIGNATION RANGE 4 DELTA TIME 90,0000 DNE OR SEVERAL TARGETS = 1 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000000
		N N	erel It	00000
	TARGETS			P.GETS 000000 666666
0.00000 .01000 .02000 .02000 0.00000 0.00000 0.00000 0.00000	SEVERAL TAR 0.00000 0.00000 84000 94000 93000 84000 84000	SEVERAL TARGETS 0.00000 0.00000 95000 94000 93000 98000 88000	SEVERAL TARGETS 0.00000 0.00000 77000 77000 74000 75000 75000 65000 65000	SEVERAL TARGETS 0.00000 0.000000000000000000000000000
0.00000 . 01000 0.00000 0.00000 0.00000 0.00000 0.00000	0.0000 DNE DE 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.0000 0.0000 0.000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00	00.0000 DNE DR 00.00000 00.0000 00.000 00.000 00.000 00.000 000.000 000.000 000.000 000.000 000.000		000 UNE UR 0.00000 0.00000 0000000000000000
0.00000 .01010 .03000 .02000 .02000 .04000 .03000	11HE 0.00 0.00000 0.00000 0.00000 0.99000 1.00000 1.00000 1.00000	TIME 0.00 0.00000 0.01000 0.01000 1.00000 1.00000 1.00000 1.00000 1.00000	TIME - 30,0000 UNE UR 0,00000 0,00000 01000 .77000 99000 .74000 99000 .72000 99000 .72000 99000 .72000 99000 .72000 99000 .72000 99000 .72000 99000 .72000	TIME 0.0000 DNE DR. 0.00000 O.00000
0.00000 .01000 .03000 .03000 .02000 .04000 .03000	4 DELTA 1 0.00000 0.00000 99000 1.00000 1.00000 1.00000	0.00000 .01000 .98000 1.00000 1.00000 1.00000 1.00000 1.00000	, DELTA 0.00000 01000 98000 99000 99000 99000 99000	4 DELTA 0.00000 0.00000
0.00000 .01000 .03000 .0700 .03000 .04000 .03000	RANGE = 0.00000 0.00000 0.00000 0.99000 1.00000 1.00000 0.99000	RANGE - 0.00000 - 0.00000 - 0.00000 - 0.00000 - 0.00000 - 0.00000 - 0.00000 - 0.00000 - 0.00000 - 0.00000 - 0.00000 - 0.000000 - 0.000000 - 0.000000 - 0.000000 - 0.000000 - 0.0000000 - 0.00000000	PANGE - 0.00000 0.01000 0.01000 0.98000 0.95000 0.99000 0.95000 0.97000 0.97000	1 RANGE= 0.00000 0.00000
0.00000 .01000 .03000 .03000 .02000 .04000 .03000	DESIGNATION 0.00000 0.00000 0.0000 0.99000 1.00000 1.00000 0.99000 1.00000 1.00000	DESIGNATION 0.00000 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	DESIGNATION 0.00000 0.01000 .88000 .95000 .95000 .97000 .97000	0.000000000000000000000000000000000000

LISTING A-4 SAMPLE OUTPUT FROM PAM (PAGE 6 OF 11)

	~	1	2
.33000 .26000 .36000 .37000 .37000 .29000	SEVERAL TARGETS = 0.00000	SEVEPAL TARGETS = 0.000000	SEVERAL TARGETS = 0.00000 0.00000 0.00000 0.00000 0.00000 0.01000
.33000 .26000 .36000 .39000 .27000 .32000	0,0000 0,0000 0,0000 0,12000 1,12000 1,13000 1,1000 0,08000 1,1000		0.0000 UNE UP
.57000 .71000 .80000 .74000 .71000 .75000	11ME=150.0000 0.00000 0.0000 23000 .45000 .45000 37000 .38000 .35000	TIME 300,0000 DNE DR 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,0000 0,00000 0,0000 0,00000 0,0000 0,00000 0,0000 0,00000 0,0000 0,00000 0,0000 0,00000 1,0000 0,0000 1,0000 0,000 1,0000 0,000	TIME = 0.00 0.00000 0.00000 .69000 1.00000
.57000 .71000 .80000 .74000 .71000 .75000	4 DELTA 0.00000 .01000 .40000 .45000 .41000 .28000 .35000	6 DELTA O. 00000000000000000000000000000000000	5 DELTA 1 0.00000 0.00000 .69000 1.00000
.57000 .71000 .80000 .74000 .71000 .75000 .73000	RANGE = 0.00000	A A M G E = 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.0000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.000000 0.0000000 0.	RANGE = 0.00000 0.00000 0.00000 .69000
.57000 .71000 .80000 .74000 .75000 .73000	DESIGNATION 0.00000 .01000 .23000 .41000 .41000 .38000 .38000	DE SI GN A TI UN 0.00000 0.00000 0.00000 0.05000 0.05000 0.05000 0.05000 0.05000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000	DF SIGNATION 0.00000 0.00000 .69000

LISTING A-4 SAMPLE OUTPUT FROM PAM 1 (PAGE 7 OF

	1	1
	#	41
• 67000	SEVERAL TARGETS = 0.00000	SEVERAL TARGETS 0.00000 0.00000 0.7000 0.13000 0.14000 0.11000 0.06000 0.15000
.67000	0.0000 0.00000 0.00000 2.2000 3.4000 2.2000 2.2000 3.8000 2.2000 2.2000	0.0000 0.00000 0.00000 0.00000 0.1000 0.11000 0.00000 0.15000
.97000	TIME * 00.0000 DHE IN. 0.00000 0.00000 0.00000 0.20000 0.50000 0.22000 0.72000 0.34000 0.77000 0.27000 0.65000 0.28000 0.57000 0.28000 0.57000 0.28000 0.57000 0.28000 0.57000 0.28000 0.57000 0.28000 0.57000 0.28000	TIME-150,0000 DHE DR. 0,00000 0,000000 0,00000 0,00000 36000 13000 36000 14000 37000 14000 37000 14000 37000 14000 37000 14000
.97000	5 DELTA 0.00000 0.00000 .29000 .72000 .72000 .66000 .67000 .71000	5 DELTA 0.00000 0.00000 .07000 .36000 .42000 .32000 .34000 .37000
. 97000	**AHIGE *** O. 00000 O. 00000 O. 29000 O. 59000 O. 72000 O. 56000 O. 56000 O. 57000 O. 57000 O. 57000 O. 71000 . 7100 O. 7100 O. 7100 O. 7	RANGE = 0.00000
00026	DESIGNATION 0.00000 0.00000 .29000 .72000 .72000 .71000 .67000 .77000	DESIGNATION 0.00000 0.00000 0.00000 0.36000 0.32000 0.34000 0.36000

	-
.15000	SEVEPAL TAPGETS 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000
.15000	0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
.46000	5 DELTA TIME=300.0000 DHT OF SEN 0.00000 0.00000 0.00000 0. 0.00000 0.00000 0.00000 0. 0.00000 0.00000 0.00000 0. 0.0000 0.00000 0.00000 0. 0.0000 0.00000 0.00000 0.
.46000	5 DELTA 0.00000 0.00000 0.00000 .04000
. 46000	RANGE = 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.050000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05
.46000	DESIGNATION RANGE 5 0.00000 0.00000 0 0.00000 0.00000 0 0.04000 0.04000 0.05000

LISTING A-4 SAMPLE OUTPUT FROM PAM (PAGE 8 OF 11)

LISTING A-4 SAMPLE OUTPUT FROM PAM

(PAGE 9 OF 11)

(PAGE 10 OF 11)

SAMPLE OUTPUT FROM PAM LISTING A-4

-	-	T.	N
APGETS =	ARGETS =	APGETS =	rapgets =
SEVERAL TARGETS 0.00000 0.00000 .02000 .15000 07000 07000 12000 .10000	SEVERAL TARGETS 0.00000 0.00000 0.00000 0.00000 0.01000 0.02000 0.02000 0.01000 0.01000	SEVERAL TAPGETS 0.00000 0.00000 0.00000 .70000 .87000 .90000 .91000 .91000 .92000	SEVEPAL TARGETS 0.00000 0.00000 0.00000 0.00000 0.90000 0.90000 0.94000 0.94000 0.94000
00 ONE OR 0.00000 0.00000 0.00000 15000 0.0000 0.0000 10000 11000	00 UNE DR 0.00000 0.00000 0.00000 0.00000 0.0000 0.0000 0.0000 0.0000	0,0000 TNE IR. 0,00000 0,00000 0,00000 0,00000 0,00000 0,0000	00 DNE DR 0,00000 0,00000 0,00000 0,9300 0,94000 0,94000 0,94000
6 DELTA TIME=150.0000 ONE OR 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.2000 0.00000 0.00000 0.31000 0.1000 0.15000 0.31000 0.31000 0.07000 0.31000 0.39000 0.08000 0.38000 0.38000 0.10000 0.35000 0.35000 0.11000	DELTA TIHE=300,0000 NNE DR. 00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,000 0,000 0,000 0,0000 0,0000 0,00	11ME 0.00 0.00000 0.00000 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000	DELTA TIME 0.0000 UNE TR 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 1.00000 1.00000 .93000 1.00000 1.00000 .93000 1.00000 1.00000 .91000 1.00000 1.00000 .94000 1.00000 1.00000 .94000 1.00000 1.00000 .94000
6 DELTA T 0.00000 0.00000 0.00000 1.0000 1.0000 2.0000 2.0000 2.0000 3.0000 3.0000 3.0000 3.0000 3.0000	6 DELTA T 0.00000 0.00000 0.00000 0.02000 0.05000 0.05000 0.05000	7 DELTA TIME 0.0000 0.00	7 DELTA 1 0.00000 0.00000 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000
RANGE = 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000	A N GE = 0.00000 0.00000 0.00000 0.00000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000 0.080	RANGE = 0.0000000000000000000000000000000000	RANGE = 0.00000 0.00000 0.00000 0.00000 0.00000 0.1.00000 0.1.00000 0.1.00000 0.1.00000 0.1.00000 0.1.00000 0.0000 0.00000 0.1.000000 0.000000
DE SIGNATION 0.00000 0.00000 0.00000 0.1000 0.1000 0.1000 0.1000 0.2000 0.3000 0.35000	DESIGNATION 0.00000 0.00000 0.00000 0.05000 0.05000 0.05000 0.05000 0.05000 0.05000	DE SI GNATION 0.00000 0.00000 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000	DE SIGNATION 0.00000 0.00000 0.00000 1.00000 1.00000 1.00000 1.00000 1.00000

.33000

.33000

.73000

.73000

.73000

.73000

1234567E901234567R9012345678901234567R90123457

A-29

	1	1		00000000000000000000000000000000000000
AP GETS ■	AP.GETS =	ARGETS =	RGETS =	00000000000 6666666677 2345678901
SEVERAL TAP GETS 0.00000 0.00000 0.00000 0.00000 0.00000 78000 68000 66000 68000 68000	SEVEPAL TARGETS 0.00000 0.00000 0.00000 22000 34000 22000 22000 30000	SEVERAL TARGETS 0.00000 0.00000 0.00000 .11000 .07000 .07000 .11000 .11000 .07000	SEVERAL TARGETS 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000	0000000000 555555566 2345678901
0.0000 0.00000 0.00000 0.00000 0.62000 1.72000 1.66000 0.66000	00 UNE UR 0.00000 0.00000 0.00000 0.28000 0.34000 0.34000 0.24000 0.22000			0000000000 444444455 2345678901
TIME 30.0000 UNE UR 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 97000 72000 98000 66000 99600 66000 99600 66000	71MF = 90.0000 UNF UR 0.00000 0.00000 0.00000 0.00000 28000 28000 71000 27000 76000 34000 77000 22000 75000 22000	TIME = 150,0000 DNE DP 0,000000	TIME=300,0000 DNE DN. 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000	00000000000000000000000000000000000000
7 DELTA T 0.00000 0.000000 0.000000 0.00000 0.97000 0.96000 0.94000	7 DELTA T 0.00000 0.00000 0.28000 71000 76000 75000 75000	7 DELTA T 0.00000 0.00000 0.00000 11000 13000 14500 14	0.00000 0.00000 0.00000 0.00000 0.05000 0.06000 0.06000	000000000000 22222233 23456789012
7.00000 0.00000 0.00000 0.00000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	RANGF = 0.00000 0.00000 0.28000 0.28000 0.71000 0.7500	P. P. ANGF = 0.00000 0.000000000000000000000000000	9.4MGE = 0.00000	111111122 345678901
DESIGNATION 0.00000 0.00000 0.00000 0.62000 0.97000 0.96000 0.94000 0.97000	0.00000 0.00000 0.00000 0.00000 . 28000 . 7000 . 70000 . 75000	DESIGNATION 0.00000 0.00000 0.00000 0.11000 0.30000 0.32000 0.28000 0.28000	0 E S J G H A T J T J H O C C C C C C C C C C C C C C C C C C	0000000000000 00000000111 123456789012

LISTING A-4 SAMPLE OUTPUT FROM PAM

(PAGE 11 OF 11)

APPENDIX B

LISTING AND SAMPLE CASE OF PRBLOS

APPENDIX B

LISTING AND SAMPLE CASE OF PRBLOS

This appendix contains:

- (1) A listing of the FORTRAN code for the PRBLOS program.
- (2) One set of sample inputs for PRBLOS.
- (3) One sample runstream for PRBLOS.
- (4) Sample output created by running PRBLOS with the sample input.

Note: The column numbers included in some of the listings in this appendix are not a part of the program code, the data, or the output, but are included only for the reader's convenience.

```
PR-PRBLOS9
PR-PRBLO10
PR-PRBLO11
PR-PRBLO12
                                                                                                                                                                                                                   PR-PRBL019
PR-PRBL020
                                                                                                                                                                                                                                                                                                                                    PR-PRBL028
PR-PRBL029
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    PR-PRBLO50
PR-PRBLO51
PR-PRBLOS2
PR-PRBLOS3
PR-PRBLOS4
                                     PR-PRBLOS5
PR-PRBLOS6
PR-PRBLOS7
PR-PRBLOS8
                                                                                                                                                                  PR-PRBL015
PR-PRBL016
                                                                                                                                                                                          PR-PRBL017
PR-PRBL018
                                                                                                                                                                                                                                             PR-PRBLO21
PP-PRBLO22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            PR-PRBL044
PR-PRBL045
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    PR-PRBL046
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       PR-PRBL054
PP-PRBL055
                                                                                                                                                                                                                                                                                                                                                              PR-PRBL030
                                                                                                                                                                                                                                                                                                                                                                                                  PR-PRBL033
                                                                                                                                                                                                                                                                                                                                                                                                                           PR-PRBL035
                                                                                                                                                                                                                                                                                                                                                                                                                                        PR-PRBL036
                                                                                                                                                                                                                                                                                                                                                                                                                                                                PR-PRB1038
                                                                                                                                                                                                                                                                                                                                                                                                                                                                             PR-PRBL039
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  PR-PRBLD42
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                PR-PRBL043
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             PR-PRBL048
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          PR-PRBL049
                                                                                                                                                                                                                                                                                                                                                                           PR-PRBLU31
                                                                                                                                                                                                                                                                                                                                                                                      PR-PRBL032
                                                                                                                                                                                                                                                                                                                                                                                                               PR-PRBL034
                                                                                                                                                                                                                                                                                                                                                                                                                                                     PR-PRBL037
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      PR-PR81041
                                                                                                                                                       PR-PRBL014
                                                                                                                                         PR-PRBL013
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     037160
037170
037180
037190
037200
037220
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          037240
                                     036800
036810
036820
036830
036840
036850
                                                                                                                                                                                                                                                          036970
                                                                                                                                                                                                                                                                                              037000
037010
037020
037020
037040
037060
037060
037080
037110
0371120
037130
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    037300
                                                                                                                                                      036890
                                                                                                                                                                                036910
                                                                                                                                                                                                                   036940
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 037260
 036770
036780
036790
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         037150
                                                                                                                                          036880
                                                                                                                                                                                                         036930
                                                                                                                                                                                                                                              036960
                                                                                                                                                                                                                                                                                    036960
                                                                                                                                                                                                                                                READ (5,280) NODV
IF (NODV.6T.20) STOP ' NODV>20 EXCEEDS DIMENSIONS OF PRODV ARRAY
                                                                                READ (5,220) TGTVEL, TC, (A(I), I=1,6)
IF (EGF(5).NE.0.0) STOP 'END OF INPUT '
WRITE (6,230) (A(I), I=1,6)
WRITE (6,240) GTVEL, TC
READ (5,280) NIV
IF (HIV, GT, 2.0) STOP 'NIV>20 FXCEFDS DIMENSIONS OF PRIV ARPAY '
DG 110 J=1,2
READ (5,250) NIV
WRITE (6,250) NIV
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             170 IF (I.Eq.1) 6G TO 190
PRIVH(1,1)=PRIV(I-1,1)+(PRIV(I,1)-PPIV(I-1,1))*(CD-PRIV(I-1,2))
1 /(PRIV(I,2)-PPIV(I-1,2))
PRIVH(1,2)=0.0
PRIGRAM PRBLUS (IMPUT, GUTPUT, TAPE5=INPUT, TAPE6=GUTPUT)
                         DIMENSION PRIV(20,2), PEOOV(20,2), PRIVH(20,2)
DIMENSION A(6)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              DO 200 J=1,2
200 WRITE (6,300) (PRIVM(I,J),I=1,NIVH)
                                                                                                                                                                                                                                                                                                                                      140 WRITE (6,300) (PPOOV(1,J),I=1,NOOV)
                                                                                                                                                                                                                                                                                     DO 130 J=1,2
READ (5,270) (PPOOV(I,J),I=1,HOOV)
WRITE (6,260) MOOV
DO 140 J=1,2
                                                                                                                                                                                                                       120 WRITE (6,300) (PRIV(I,J), I=1,NIV)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  IF (PRIVM(I,2).6T.0.0) GD TO 170 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                WRITE (6,310) CD, FRIV(NIV, 2)
GN TN 210
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 HIVM=HIV-1+2
DD 180 K=2,NIVM
PRIVM(K,1)=PRIVM(I-2+K,1)
PRIVM(K,2)=PRIVM(I-2+K,2)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                  PRIVM(I)1)=PRIV(I)1)
PRIVM(I)2)=PRIV(I)2)-CD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  WP.ITE (6,320) NIVII
                                                                                                                                                                                                                                                                                                                                                                                                      DG 150 I=1, NIV
                                                                                                                                                                                                                                                                                                                                                                                                                                                       DO 160 I=1, NIV
                                                                   100 WPITE (6,290)
                                                                                                                                                                                                                                                                                                                                                                            CD=TC*TGTVEL
                                                                                                                                                                                                                                                                                                   130
                                                                                                                                                                                                                                                                                                                                                                                                                                150
                                                                                                                                                                                    110
```

LISTING B-1 FORTRAN LISTING OF PRBLOS PROGRAM (PAGE 1 OF 3)

	037310	PR-PR81056	
CALL AVEL (DDIV.20.2.NIV.AVEIV)	00000	00-0001067	
4 VE P	037330		
1 .	00000	FR-FRBLU30	
CALL AVEL (PRIVAGO ZORIVMS A VEIVM)	037340	PR-PR81059	
υ	037350	PR-PRBL060	
WRITE (6,330) AVELV, AVELOV, AVELVM	037360	PR-PRBL061	
	037370	PR-PRBL062	
PRBIVM=AVEIVM/(AVEIV+AVEDOV)	037380	PR-PRBL063	
WRITE (6,340) PRRIVM	037390	PR-PR8L064	
	037400	PPPRBL065	
210 WRITE (6,350)	037410	PR-PR81066	
60 10 100	037420	PR-PRBL067	
	037430	PR-PRBL068	
	037440	PR-PRBL069	
C ** * FORMAT STATEMENTS * * *	037450	PR-PRBL070	
	037460	PR-PRBL071	
FORMAT	037470	PR-PRBL072	
FORMAT	037480	PR-PRBL073	
FURMAT (037490	PR-PRBL074	
FORMAT (037500	PR-PRBL075	
FORMAT (037510	PR-PRBL076	
FORMAT	037520	PP-PR81077	
FORMAT	037530	PR-PRBL078	
FURNA	037540	PR-PRBL079	
		PR-PRBL080	
310 FORMAT (1H + //) 19H CRITICAL DISTANCE=+F10.4,72H WHICH IS GREATER	T037560	PP-PRBLU81	
THAN OR EQUAL TO THE LOWGEST POSSIBLE IN-VIEW SEGMENT , F10.4,1,23H;037570	H;037570	PR-PRB1082	
2 THERFFORE, PRBLOS=0.0)	037580	PR-PR81.083	
320 FDRMAT (20H PRIVM ARRAY: NIVM= ,15)	037590	PR-PRBLO84	
330 FORMAT (1H +//-32H AVERAGE IN-VIEW SEGMENT LENGTH=+F10.4+/-36H AVE037600	VE037600	PR-PRBL085	
1RAGE GUT-OF-VIEW SEGMENT LENGTH=,FIO.4,7,41H AVERAGE MODIFIED IN-V037610	-V037610	PP-PRBL086	
2IEW SEGMENT LENGTH= #F10.4)	037620	PR-PRBLO87	
340 FORMAT (1H , 1/2, 8H PREL OS=, F10, 4)	037630	PR-PR81088	
350 FORMAT (IH , //, 1341 END OF CAST , //)	037640	PR-PRBL089	
END	037650	PR-PRBL090	

LISTING B-1 FORTRAN LISTING OF PRBLOS PROGRAM - CONT'D

(PAGE 2 OF 3)

123	00000000011111111112222222233333333344444445555555556666666666	38888889 C	OLUMN NUMBERS READ VERTICALLY)
		R-AVEL 2	
U	037680	SR-AVEL 3 SR-AVEL 4	
U	037700	SR-AVEL 5	
	037720	SR-AVEL 7	
		SR-AVEL 8	
	(-21-p(1-2))*(p(1+1-1)+p(1-1))	R-AVEL 9	
-	037750	SR-AVEL 10	
٠,	037760	SR-AVEL 11	
ر	ANT - DIMA - 114 DIMA - 31 - DI 1 - 11 + DI (1 - 2) 5 + SUM	R-AVEL 12	
	037780	SP-AVEL 13	
	037790	SR-AVEL 14	
000	00000000111111111112222223333333334444444444	88888889 (234567890	COLUMN NUMBERS (READ VERTICALLY)

LISTING B-1 FORTRAN LISTING OF PRBLOS PROGRAM - CONT'D

(PAGE 3 OF 3)

.7 180.	.9 175. ETFRS	.7 200•	.9 175. ETERS	.7 240.	.9 175.
140.	.874 150. TD 2500 ME	.6	.874 150. 10 999 NE	210.	.874
.5	.865 125.	.5 120.	.865 125. 127.	.5	.865
70.	.8 .874 .97 1.0 75 100. 1800. TERPAIN: RAHGE BAND FPOM 2000 TO 2500 HETERS	70.	.8 .85 .865 .874 .99 1.0 125. 150. 75. 100. 125. 150. 800. 1000.	140.	.85 1.0 100.
.3 50.	.8 .99 75. 800. ERRAIN: P.	• 3 50•	.8 .99 75. 800.	.3	. 8 75 800
. 2 1.0 40. 1100.	.743 .98 50. 600.	.2 1.0 40. 1520.	.743 .98 50. 600. CLOSE T	.2 1.0 60. 1600.	. 743 . 98 50.

LISTING B-2 SAMPLE INPUT FOR PRBLOS

JOB CARD. CHANGE TO CONFORM TO INSTALLATION USAGE.

ACCOUNT CARD. CHANGE TO COMFORN TO INSTALLATION USAGE.
COMMENT. THE FOLLOWING CARD ATTACHES THE MACHINE LANGUAGE (OBJECT CODE) FILE
COMMENT. DF. THE PRELOS PROGRAM. THIS FILE WAS CREATED BY RUNNING THE SOURCE
COMMENT. LISTING OF PRELOS THROUGH THE FORTRAN COMPILER IN A
ATTACH-LOG-PRELOS BINARY, ID=SANDHEYER.
COMMENT. PREVIOUS JOB.
ATTACH-LOG-PRELOS BINARY, ID=SANDHEYER.
COMMENT. BE OBTAINED FROM THE "FRONT END" COMPUTER WHICH USES A DIFFERENT
COMMENT. BE OBTAINED FROM THE "FRONT END" COMPUTER WHICH USES A DIFFERENT
COMMENT. DEFAULT RECORD TYPE FOR ITS FILES.
FILE, TAPES, AT=Z,FL=80, BT=C.
COMMENT. THE NEXT CARD OBTAINS A COPY OF TAPES (PRBLOS INPUT FILE) FROM
COMMENT. THE WERDNT END" MACHINE.
GETPE, TAPES, PREUSSAMPLEINPUT, ID=SANDHEYER, ST=HRA.
COMMENT. THE WENT CARD LOADS AND EXECUTES THE PROGRAM USING TAPES AS INPUT.
LGOTTAPES)

LISTING B-3 SAMPLE RUNSTREAM FOR PRBLOS

			. 7000		180.0000			0006		175.0000			0006.		455,0000	
			0009*		140.0000			.8740		150.0000			.8000		235,0000	
			.5000		120,0000			.8650		125,0000			. 7000		135,0000	
METERS			.4000		70.0000			.8500	1.0000	100.0000	1000,0000		• 6000		05.0000	
FRO TH 2000			.3000		20.000			.8000	0066*	75,0000	800,0000		.5000		75.0000	
BAND FROM Z	= 15,0000		. 2000	1.0000	40.0000	1100,0000		. 7430	0086	50,0000	0000:0009		. 4000		25,0000	
RRAIN: PANGE	• 0000	V= 11	.1000	0006.	30.0000	500,0000	1007= 13	.6100	.9500	25.0000	400.0000	1 VM= 9	.3000		5.0000	
CASE: CLUSE TERRAIN: PANGE BAND FROM ZERO TO 2000 METERS	TGTVEL= 3	PRIV ARRAY: NI	0000 10	. 8000	25.0000	280,0000	~	0000 •0	.9100	0000 •0	200,0000	PRIVM ARRAY: N	. 2500	1.0000	0000.0	1055,0000

AVERAGE IN-VIEW SEGHENT LENGTH* 197.2500
AVERAGE GUT-NF-VIEW SEGMENT LENGTH* 72.5750
AVERAGE MCDIFIED IN-VIEW SEGMENT LENGTH* 155.1250

.5749 PR BL 05 =

END OF CASE

LISTING B-4 SAMPLE OUTPUT FROM PRBLOS

(PAGE 1 OF 3)

	• 6000	150.0000			.8740		150,0000			.8000		375.0000	
	• 5000	120.0000			.8650		125.0000			. 7000		155.0000	
METERS	.4000	70,0000			.8500	1.0000	100.0000	1000,0000		• 6000		105,0000	
000 TH 2500	.3000	50.0000			.8000	0066.	75.0000	800,0000		. 5000		75.0000	
BAND FRUM 2. . 15.0000	.2000	40.0000	1520.0000		.7430	.9800	50.0000	6000.000		. 4000		25.0000	
	1000	30.000	0000,000	400V* 13	.6100	.9500	25.0000	400.0000	IIVM≖ 9	• 3000		5.0000	
CASE: CLOSE TERRAIN: RANGE BAND FROM 2000 TO 2500 METERS TGTVEL" 3.0000 CT" 15.0000 PRIV ARRAY: NIV" 11	0000 *0	25.0000		PROUV ARRAY: N	0000 0	.9100	0000 0	200,0000	PRIVN ARRAY: N	.2500	1.0000	0000 0	1475.0000

.7000

200.0000

.9000

175.0000

0006.

855,0000

AVERAGE IN-VIËW SEGNENT LENGTH= 275.2500 AVERAGE DUT-OF-VIEW SEGMENT LENGTH= 72.5750 AVERAGE MODIFIED IN-VIEW SEGMENT LENGTH= 233.1250

PRBLUS= .6702

END OF CASE

LISTING B-4 SAMPLE OUTPUT FROM PRBLOS (PAGE 2 OF 3)

	. 7000	240.0000		0006.		175.0000			.8000		265.0000	
	0009•	210,0000		.8740		150.0000			• 7000		195.0000	
	.5000	190.0000		.8650		125,0000			.6000		165.0000	
METERS	• 4000	140.0000		.8500	1.0000	100,0000	1000,0000		• 5000		145,0000	
500 TB 9999	• 3000	100,0000		.8000	0066*	75,0000	800,0000		. 4000		a5.0000	
BAND FROM :	. 2000	60.0000		.7430	.9800	50.0000	600.0000		.3000		55,0000	
ERRAIN: RANGE 3.0000 CT	1000	90	NOOV = 13	.6100	.9500	25.0000	400.0000	VIVN≈ 10	.2000	1.0000	15.0000	1555,0000
CASE: CLOSE TERRAIN: RANGE BAND FROM 2500 TO 9999 METERS TGTVEL = 3.0000 CT	0000 •0	25,0000		0.000	.9100	0000 •0	200,0000	PRIVM ARRAY:	.1250	0006.	0000 0	545,0000

AVERAGE IN-VIEW SEGMENT LENGTH= 269.2500 AVERAGE DUT-OF-VIEW SEGMENT LENGTH= 72.5750 AVERAGE MODIFIED IN-VIEW SEGMENT LENGTH= 225.5625

PR.BL.US= .6590

END OF CASE

LISTING R-4 SAMPLE OUTPUT FROM PRBLOS

(PAGE 3 OF 3)

APPENDIX C

LISTING AND SAMPLE CASE OF PREPMS

APPENDIX C

LISTING AND SAMPLE CASE OF PREPMS

This appendix contains:

- (1) A listing of the FORTRAN code for the PREPMS program. In addition to the routines in this listing, PREPMS also uses the functions IDCHAR and NUMRIC and the subroutine PENAME which are included in the COPE listing in Appendix D.
 - (2) One set of sample inputs for PREPMS.
 - (3) One sample runstream for PREPMS.
- (4) Sample output created by running PREPMS with the sample input (and with the records created by the three sample cases of PAM already written to TAPE 11).

Note: The column numbers included in some of the listings in this appendix are not a part of the program code, the data, or the output, but are included only for the reader's convenience.

```
000000000111111111122222222333333334444444445555555666666667777777888888888 COLUMN NUMBERS
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890 (READ VERTICALLY)
                                                                                                                                                                                                                                                                                                                                                                                              CM+HIT 4
CM+PANDDC2
CM+RNGLDS2
CM+RNGLDS3
                                                                                                                                                                                                                                     CM+RSPTIM2
CM+RSPTIM3
CM+RSPTIM4
CM+RSPTIM5
                                                                                                                                                                                                                                                                                                                                                                 CM+SYNBOL3
CM+WEATHR2
                                            PR-PREPMS2
PR-PREPMS3
PR-PREPMS4
                                                                                         CM+DBDF 2
CM+DDDF 3
CM+INDEX12
CM+HIT 2
CM+HIT 3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 PR-PREPM22
PR-PREPM23
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PP-PREPM25
                                                                                                                                                                                                                                                                                                    CM+SADARB2
CM+SADARB3
                                                                                                                                                                                                                                                                                                                                  CM+SADARB4
CM+SYMBOL2
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                                                                                                                        000470
                                                                                                                                                                                  COMMON TRANDOC TCRIT, HPLOSB, RNGPLS(10), PRELOS(10)

COMMON TRIGLAS, HPP, HRNGCL, CPHGR(11,2), SEGLOS(11,11), 000740

I RNGCLB(11), VELTBL(2,2)

COMMON TSPITM, BATRH(3,2), XHVADE(2), DUM1, BCSPTH(2,2), XHTITM(2,007750

COMMON TSPITM, PRDAR, PRSDT, PETTAL(10,2), RETA(2,2), DETTIH, 000810

2 PRSPTH, FRBAR, PRSDT, PRSVT, ALPHA(2,2), RETA(2,2), DETTIH, 000810

3 IDSGTP, RUHC, PCRNSG, PRDUM

COMMON TSADRB/ HAX, PACQ(10), PRILL(10,7), SCAMP(10), RADIS, 000800

1 RAGALIO), BEREX(10), PERPX(10), PEPRX(10), PERRY(10), NTAB, 000870

COMMON TSYMD'L FLAMK, DECPHT, ALFBET(27), ANUMBR(11), SEP(5), 000970
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 032420
032430
032440
032450
                         PROGRAM PREPHS (INPUT, OUTPUT, TAPES::INPUT, TAPES:OUTPUT, DEBUG=OUTPUT 032250
1 , TAPE4, TAPE11)
032270
                                                                                             000250
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1227 , IRLT6 /42607 , IRLT7 /417 , IRLT8 /1677 , ICHRRL /3007
DATA IRLT9 /1437
                                                                                                                                                                          000430
                                                                                         LOGICAL DOKILD
COMMON /INDEXI/ INDEXI/(5.5.2), PETBL(60,10,7), DLTT(6), PKTBL(10,2),
COMMON /HIT/ INDEX(6,5,2), PETBL(60,10,7), DLTT(6), PKTBL(10,2),
I NRHGIT, RHGITT(20), TIF(3,20,2), NPNGPS, RNGPST(10), PSTTBL(10,2,3)
                                                                                                                                                                                                                                                                                                                                                                              COMMON /WEATHR/ PRCLCG, PRCFLS(2), PRGCFL(11,2), W(6,11,2), VIS(11), CLOUD(6), NCC, NVL, PASQL(6), WNDSPD(3,3), HUMID(2), NS(11), WCFSUH(2), ICC, IVL
                                                                                                                                                                                                                                                                                                                                                                                                                                                              DIMENSION WDATA(193), ACQDAT(161), PSPDAT(49), DFSDAT(31)
DIMENSION PODATA(22), PEDATA(4260), PSTDAT(41), AINVDA(167)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        EQUIVALENCE (WDATA(1), PRCLCG)
EQUIVALENCE (ACQBAT(1), BATETH(1))
EQUIVALENCE (ESPDAT(1), BATETH(1))
EQUIVALENCE (DESTAT(1), DFDCH(1))
EQUIVALENCE (RCDATA(1), TCRIT)
EQUIVALENCE (PENTA(1), INREST)
EQUIVALENCE (PITDAT(1), NRNGFS)
EQUIVALENCE (AINVOA(1), NLTT(1))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DIMENSION A(80), E(8,10)
DIMENSION ILIST(200)
DIMENSION CHARA(10,30), HUPTHH(70)
DIMENSION IEAY(6)
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                                                              1 STAPE4,TAPE11)
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LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM

(PAGE 1 OF 12)

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COLUMN MUMBERS (READ VERTICALLY)
PR-PREPM76
PR-PREPM77
PR-PREPM78
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PR-PREPM70
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PR-PREPM75
                                    PR-PREPM28
PR-PREPM29
PR-PREPM31
PR-PREPM31
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PR-PREPM36
PR-PREPM37
PR-PREPM38
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PR-PREPM49
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PR-PREPM60
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PR-PREPM64
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PR-PREPM33
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PR-PREPM40
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PR-PREPM42
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PR-PREPM51
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PR-PREPM53
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PR-PREPM72
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032650
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032720
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                                                                                                                                                                                                                                                                                                                                                              032770
                                                                                                                                                                                                                                                                                       540
                                                                                                                                                                                                                                               WEITE (6,640) (A(I), I=1,80)
CALL SEPRCZ (A,80,8,8))
If (*NOT.NUMRIC(E,8,10,1)) STOP ' IN PREPMS: ERROP NUMBER 4 '
DECOLG (IO,630,8(1,1)) IDPT
IF (*NOT.NUMRIC(B,P,10,2)) STOP ' IN PREPMS: FRROR NUMBER 5 '
DECODE (IO,630,8(1,2)) XLEV
                                                                                                                                                                                                                                                                                                                                                                                                                             WRITE (6,680) CLABEL
IF (.NOT.NUMRIC(0,8,10,3)) STOP * IN PREPMS: ERROR NUMBER 2
DECODE (10,630,P(1,3) )X
                                                                                                                                                                                                                                                                                                                                                                                                                                                                          IF (.HOT.NUMPIC(R.8.10.4)) STOP ' IN PRFPMS: FREDR NUMBER 3 DECODE (10,630,6(1,4) )Y
                                                                                                                                                                          READ (5,610) (A(I),1=1,80)
IF (EOF(5),e0-0.0) GO TO 110
IC CLOSMS (11)
STAP IN PREPMS: HORMAL PROGRAM TERMINATION
                                                                                                                            CALL OPENNS (11, INDX11, 2001, 1)
CALL READMS (11, MOPTHM, 70, RHOFTHNUMS)
                                                                                                                                                                                                                                       WRITE (6,640) (A(I), I=1,80)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  READ (5,610) (A(I), I=1,80)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 WPITE (6,690) NREAD, NOPTI
                                                   IRAY(1)=0
IRAY(5)=LOCF(NORFC2)
CALL SYSTEMC (104,IRAY)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          CHARA(2+IK, IJ) = B(IK, 3)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          DO 170 IJ=1, NREAD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    CHARA(2, IJ) = XLEV
                                                                                                                                                                                                                                                                                                                                                                                         CHARA(I,J)=BLANK
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                 CHARA(I, 1) = 0.0
DO 140 I=3,10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CHAPA(1, IJ) = OP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DO 160 IK=1,8
                                                                                                                                                                                                                                                                                                                                          DU 150 J=1,30
                                                                                                                                                                WP.ITE (6,720)
                                                                                                                                                                                                                                                                                                                                                                                                                  CLABEL=8(1,2)
                                                                                                    WP.ITE (6,710)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         160 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 HREAD=X
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LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM - CONT'D

(PAGE 2 OF 12)

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PR-PREPIOD
PR-PREPIOD
PR-PREPIOD
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PR-PREPIOD
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PR-PREPIOD
PR-PREPIID
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                                             PR-PREPM82
PR-PREPM83
PR-PREPM84
PR-PREPM85
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PR-PREPM96
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PR-PREPM87
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PR-PREPM98
PR-PREPM99
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PM99
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PP-PREPM91
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PR-PREPM89
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033440
033440
033450
033470
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033550
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033320
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033380
033390
033400
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033200
033210
033220
033220
033240
033260
033280
033280
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033090
033100
033120
033130
033140
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                                             033050
033060
033070
                                                                                                                                                        IF (*NOT.NUMRIC(B, B,10,3)) STOP ' IN PREPMS: ERROR NUMBER 6
DECODE (10,630,R(1,3)) 2CASF
ICASE=ZCASE
WRITE (6,700) RLAREL, ICASE
                                                                                                                                                                                                                               GO TO (190,240,290,320,350,370,430,460,500), ICASE
                                                                                                                                                                                                                                                          90 DO 200 I=1,IRLT1
00 WDATA(I)=0.0
READ (5,620) MCC,NVL
WRITE (6,650) MCC,NVL
READ (5,630) PRCLC6,(PRCLLS(I),I=1,2)
WRITE (6,660) PRCLC6,(PRCLLS(I),I=1,2)
READ (5,630) (PRGCFL(I,1),I=1,1)
10 WRITE (6,660) (PRGCFL(I,1),I=1,11)
DO 220 K=1,2
                                                                           NOPTNH(NOPTI)*NPEAD
CALL WRITHS (11,CHAPA,ICHPRL,CLABEL,-1)
CALL WRITHS (11,HOPTHM,70,8HOPTHMUMS,-1)
GO TO 100
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  READ (5,630) (HUMID(1),1=1,2)
WRITE (6,660) (HUMID(1),1=1,2)
CALL WRITHS (11,WDATA,IRLT1,RLABEL,-1)
GO TO 530
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        50 ACQDAT[1]=0.0

READ (5,620) NRP, NPP, NRNGCL

WRITE (6,650) NRP, NPP, NRNGCL

NRNGCB=NRCCL+1

DT 260 J=1,2

READ (5,630) (CRNGD[1,J), I=1, NRP)

NRITE (6,660) (CRNGD[1,J), I=1, NPP)

READ (5,630) (SECLOS(1,J), I=1, NPP)

WRITE (6,660) (SECLOS(1,J), I=1, NPP)
                                                                                                                                                                                                                                                                                                                                                                                                     DU 220 N-1,1

READ (5,630) (W(1,1,1,1),1=1,6)

READ (5,630) (W(1,1,1,1,1)=1,6)

READ (5,630) (CLOUD(1),1=1,0)

WRITE (6,660) (CLOUD(1),1=1,6)

WRITE (6,660) (CLOUD(1),1=1,0)

WRITE (6,660) (PASQL(1),1=1,6)

BRITE (6,660) (PASQL(1),1=1,6)

READ (5,630) (WNDSPD(1,1,1=1,6)

READ (5,640) (WNDSPD(1,1,1=1,6)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DO 250 I=1, IRLT2
                                                                                                                                                     F.L ABEL = B (1,2)
                                                    170 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                       220
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LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM - CONT'D (PAGE 3 OF 12)

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PR-PREP151
PR-PREP152
PR-PREP153
PR-PREP154
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PR-PREP157
PR-PREP158
PR-PREP159
PR-PREP160
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PR-PREP165
PR-PREP166
PR-PREP168
PR-PREP170
PR-PREP171
PR-PREP173
PR-PREP174
PR-PREP174
PR-PREP176
PR-PREP176
PR-PREP176
PR-PREP177
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PR-PREP163
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PR-PREP182
PR-PREP183
PR-PREP184
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                                              033590
033600
033610
033620
                                                                                                               033640
033650
033660
033670
033680
033690
                                                                                                                                                                                                                                                                                       READ (5,630) (BATRIH(I), I=1,3), (XHVADF(I), I=1,2)
WRITE (6,660) (BATRIH(I), I=1,3), (XHVADF(I), I=1,2)
READ (5,630) ((BCSFTM(I,1), I=1,2), I=1,2), (XHYTHH(I,1), I=1,2), J=1,033790
                                                                                                                                                                                                                                                                                                                                                                                                                                    033870
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                                                                                                                                                                                                                                                                                                                                             WRITE (6,660) ((BCSPTH(I,J),I=1,2),J=1,2),((XHTTH(I,J),I=1,2),J=1033810
                                                                                                                                                                                                                                                                                                                                                                        READ (5,630) ((THEAN(1,1),1=1,2),1=1,2), ((TSIGMA(1,1),1=1,2),1=1, 033830
                                                                                                                                                                                                                                                                                                                                                                                             2)
WRITE (6,660) ((TMEANKI,J),I=1,2),J=1,2),((TSIGMA(I,J),I=1,2),J=1,033850
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                                                                                                                                                                                                                                                                                                                                                                                                                             READ (5,630) ((TRARRY(I,J),I=1,3),J=1,2)
WRITE (6,660) ((TRARRY(I,J),I=1,3),J=1,2)
CALL WRITHS (11,RSPDAT,IRLT3,RLABFL,-1)
                                                                                                                         CONTINUE
CALL WRITMS (11,ACQDAT,IRLT2,RLABEL,-1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           CALL WRITMS (11, DFSDAT, IRLT4, RLABEL, -1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 READ (5,630) (DFDDKL(1,J), I=1,NDFSP)
WRITE (6,660) (DFDUKL(1,J),I=1,NDFSP)
                                     CONTINUE
READ (5,630) (RNGCLB(I), I=1, NRNGCL)
WRITE (6,660) (RNGCLB(I), I=1, NRNGCL)
D 280 J=1,2
READ (5,630) (VELTBL(I,J), I=1,2)
WRITE (6,660) (VELTBL(I,J), I=1,2)
                                                                                                                                                                                                                                   DG 310 J=1,2
READ (5,630) (DETTMA(1,J),I=1,NDT)
WRITE (6,660) (DETTMA(1,J),I=1,NDT)
CONTING
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               WRITE (6,660) (PRGPLS(I),I=1,HPLGSR)
WRITE (6,660) (PRBLGS(I),I=1,HPLGSR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              READ (5,620) NPLDSR
READ (5,630) TCRIT
READ (5,630) RRIGHLS(1), I=1, MPLDSR)
READ (5,630) (PRRIDS(1), I=1, MPLDSR)
WRITE (6,650) MPRIDS
WRITE (6,660) TCRIT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DD 330 I=1,IRLT4
DFSDAT(I)=0.0
READ (5,620) NDFSP
WRITE (6,650) NDFSP
                                                                                                                                                                                           RSPDAT(I)=0.0
READ (5,620) HDT
WRITE (6,650) NDT
                                                                                                                                                                               DO 300 I±1, IRLT3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DO 360 I=1, IRLTS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    RUDATA(I)=0.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        DO 340 J-1,3
                                                                                                                                                     GO TO 530
                                                                                                                                                                                                                                                                                                                                                                                                                                                                        GO TO 530
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WRITE (6,650) NRNGTT
BO 480 J=1,NRNTT
READ (5,630) RNGTF(J), ((TTF(I,J,K),K=1,2),I=1,3)
WRITE (6,660) RNGTTF(J), ((TTF(I,J,K),Y=1,2),I=1,3)
READ (5,630) (DUTT(I),I=1,6)
BRANTE (6,660) (DUTT(I),I=1,6)
DR 490 J=1,2
                                                                                                                                             ENCODE (20,610,B(1,1) )(A(1),1=1,20)

BECODE (20,670,B(1,1) )(INDFX(1,1,K),K=1,2)

COMTINUE
                                                                                                                                                                                                                                                                                                                                                                          READ (5,620) NRNGPS

WEITE (6,620) NRNGPS

WEITE (6,630) (PNGPST(I), I=1, HRNGPS)

WRITE (6,660) (PNGPST(I), I=1, HRNGPS)

READ (5,630) (PSTFBL(I,J), I=1, HRNGPS)

WRITE (6,660) (PSTFBL(I,J), I=1, HRNGPS)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CALL WRITHS (11, PSTDAT, IRLT, RLABFL, -1)
CALL WRITMS (11, RODATA, IRLT5, RLABEL, -1)
60 TO 530
                                                                                                                                                                                                                                                                            00 420 1=1,60

DD 420 J=1,10

READ (IUNIT,630) (PETBL(1,J,K),K=1,7)

WRITE (6,660) (PETRL(1,J,K),K=1,7)

CONTINUE
                                                                                                                                                                                                                                      READ (IUMIT, 670) (INDEX(I, J, K), K=1,2)
WRITE (6,650) (INDEX(I, J, K), K=1,2)
CONTINUE
                                                                                                                                                                                                               IF (I.Eq.1.AND.IUNIT.FQ.5) ISTART=2
DO 410 J=ISTART.5
                                                                      READ (5,610) (A(I),I=1,80)
CALL SEPRC2 (A,80,E,8,10)
IF (8(1,1),NE,8HUSETAPE4) GO TO 390
IUHIT=4
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                490 WRITE (6,660) (PKTBL(1,3),1=1,7)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    FEAD (5,630) (PKTEL(I,J),I=1,7)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            DO 470 I=1, IPLTB
                                                                                                                                                                                                                                                                                                                                                                 430 00 440 I=1, IRLT7
                                         DO 380 I=1, IRLT6
PEDATA(1)=0.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         AIMVDA(I)=0.0
                                                                                                                           WRITE (6,600)
GO TO 400
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ISTART=1
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         CALL PEIDNT (TIPIZPTSPT4, TSPT6, TR, TR, T9, IPECOD)
                                       CALL WRITHS (11, AINVDA, IRLTB, ELABEL,-1)
GO TO 530
                                                                                                                                                                                                                                                                                                                                                                                                                                         CALL WRITMS (11, WPNDAT, IRLTO, RLABEL, -1)
                                                                                                                                                                                                               READ (5,630) (SCAMR(1), 1=1,MAX)
READ (5,630) RADIS
READ (5,630) RADIS
READ (5,620) NTAB
WRITE (6,660) RADIS
READ (5,630) RTAB(1), 1=1,NTAB)
READ (5,630) (RTAB(1), 1=1,NTAB)
READ (5,630) (RTAB(1), 1=1,NTAB)
READ (5,630) (RERX(1), 1=1,NTAB)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                WRITE (6,730) (ILIST(IJ), IJ=1, IDUT)
                                                                                                                                                                          READ (5,630) (PKILL(I,J),I=1,MAX)
WRITE (6,660) (PKILL(I,J),I=1,MAX)
CONTINUE
                                                                                                         READ (5,620) MAX
WRITE (6,650) MAX
READ (5,630) (PACQ((1,1=1,MAX))
WRITE (6,660) (PACQ((1),1=1,MAX))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  DG 570 I=2,2000,2
BCGDE (10,580,1MbX11(1) )PECHK
IF (FCHK.NE,4MPE00) GG TG 570
IPFCOD=INDX11(1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DD 550 I=2,2000,2

IF (IMDX11(I).Eq.0) GD TD 55

ILIST(IDUT)=IMDX11(I)

ILIST(IDUT+1)=IMDX11(I+1)

INUT=IDUT+2
                                                                                 DO 510 I=1, IRLT9
                                                                                             WPNDAT(I)=0.0
                                                                                                                                                               DU 520 J=1,7
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              530 CONTINUE
GD TO 100
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590 FORMAT (5X,11HPE RECORD: ,A10,4H TR=,F4.0,4H DT=,II,5H VEL=,F2.0,5035290
1H GTR=,F3.0,6H RFCL=,F4.2,8H ANGLTT=,F4.0,4H DT=,II,5H VEL=,F2.0,5035290
2F3.0,7H SKSEN=,F3.0)
600 FORMAT (1H, 3.6H TAPF4 USFD TO INPUT THIS PE DATA:)
610 FORMAT (1H, 3.6H TAPF4 USFD TO INPUT THIS PE DATA:)
620 FORMAT (1H, 3.6H TAPF4 USFD TO INPUT THIS PE DATA:)
620 FORMAT (1H, 9.615)
633 FORMAT (1H, 9.80A1)
640 FORMAT (1H, 9.80A1)
650 FORMAT (1H, 9.810,4)
660 FORMAT (1H, 9.810,4)
660 FORMAT (1H, 3.3H HATICH WOPD TYPE PECORD NAMED:,A10,13H BEING INPOS5400
615110
617 JOHNAT (1H, 3.3H HATICH WOPD TYPE PECORD NAMED:,A10,13H BEING INPOS5400
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720 FORMAT (1H ,8(1OH* * * * * ))
720 FORMAT (1H ,9(1) H ,9(2H )
730 FORMAT (1H ,9(2H ))
730 FORMAT (1H ,9(2H ))
11H ,3(Al0,2X,020,10X)))
035490
610
                                                                                                                                                                      035220
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   690 FORMAT (1H ,12,37H OPTION CARDS READ FOR KEYWORD NUMBEP,13) 035420
700 FORMAT (1H ,16H PECORD NAMED : ,410,9H OF TYPE ,12,16H NOW BEING R035430
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             035440
                                                                                                                                                                                                                                                                                                                                                STATEMENTS **
                                                                                                                                                                                                                                                                                                                                                FURMAT
                                                                                                                                                                                                                         60 TN 100
                                                                                                                                        570 CONTINUE
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LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM - CONT'D

(PAGE 7 0F 12)

								035510	BD-BDATA22	
تد	COMMON /LOGFLG/ LOGICAL FIRSTL	DEFLEY FIRSTL, RSTL, SFONML,	FIRSTL, SEGNML, SPCL(70), SHRIEC, FISIL SFONML, SPCL, SHPIEC, FISIL	SPCL (7	101, SHR	FEC, FT	FTSILL	000510		
ິຸ	DOLLAR	MBOLZ BLANK,	DEC PNT,	ALF BET (27), AH	IMAR (1.1), SEP(5),		CM+SYMBOL2 CM+SYMBOL2	
ن	OMMON /XV	COMMON /XVALUE/ XVALUF(R,9,2)	8,9,2)					001100	CM+XVALUE2	
*	*	FILL IN LOGFLG COMMON RLOCK	FLG COMM	ON BLOC	*	* *		035560	80-80A1A27 DT+L06FLG2	
66	DATA FIRSTL	/.TRUE./	SEGNML /	1.FALSF./	_			001430	DT+LOGFLG3 DT+LOGFLG4	
20		/.TPUE./	ru*•FALS	,				001450	DT+L06FL65	
•								001460	DI+LUGFLG6 DI+SYMBOL2	
¥	* * h	FILL IN SYMBOL COMMON BLOCK	BOL COMM	ON BL DC	*	*		001490		
õõ	DATA BLANK	BLANK /IH / , DECPNT /IH./	4T /1H./	į	111	į	:	001510		
1	1HL, 1HM	, ,	IP, 1H0,	1HR, 1	HS, 1HT,	1 1HU,	THIS THUS	THE THE THE THE THE THE THE THE THE THE	DI+SYMBOL6	
2	Z IHY, IHZ, 1H'/ DATA ANIMBP /1H	INY, 18Z, 18"/ DATA ANUMRP /140, 1812, 182, 182	1113	211	200	;		001240	DT+SYMBOL8	
1,		. (7)17 (0)17 (1)	LUC TUB	6 FEI 1	full four	t TH (148, 149,	1H-001550	DT+SYMBOL9	
ءَ ۾	DATA SEP /	SEP /1H3, 1H7, 1H3, 1HG, 1H)/	1H(, 1)	7.1				001570	DT+SYMBO11	
5		74117						001580	DT+SYMBO12	
*	*			;				001610	DT+XVALUE2	
		TILE IN AVALUE COMMUN BLUCK	THE CIMEN	IN BLUC	* *	* *		001620	DT+XVALUE3	
ã	VAX (C XV	DATA (((XVALUE(I)J)K)) I=198),K=1,2),J=1,9)	1.88),K=1	= L e (S e.	1,99 /			001640	DT + XVALUES	
	8*0.	Stors for nom	INAL REST	ONSF 1	TIMES			001650	DT+XVALUE6	
2	8*8							001670	DI + XVALUE	
	DESIGN,	TESIGNATOR TYPES						001680	DT+XVALUE9	
- 2	0	1., 1.,	5.0					001690	DT+XVALU10	
	TARGET	III						001/100	DI+XVALUII	
٦,	2.0	3., 5.,	8.	0	3*0.,			001720	DI+XVALU13	
3	GUN-TAR	GUN-TARGET PAHGES	2.0	2.3	3*8.,			001730	DT + XVALU14	
 (8.3	12., 20.,	30.,	4.0.	10.0	16.,	0.0	001750	DI+XVALUIS DI+XVALUI6	
2	00.0	0.5 I., 2., been the	3.,	•••	5.,	6.9	8.,	001760	DT+XVALU17	
-	.059	.105 .209	.30,	**0*5				001770	DT+XVALU18	
~	0.0	, l.,	3.,	4*8*				001790	DI+XVALU20	
_	AFIGLES		9	ć	•			001800	DT+XVALU21	
۰ م	•	1.9 2.9	3.6		120.	2*0.,		001810	DT+XVALU22	
,	DEFLECT	ION BIAS	•		,	•		001830	DI + XVALUZS	
ц,	-200.	-100.,	100.	200.	3*0.			001840	DT+XVALU25	
ż.	TARGET	ARGET HEADINGS	4.5	•••	3*8.			001850	DT+XVALU26	
-	-60.	-30., 0.,	30.9	60.	3*0.			001820	DI+XVALUZ/	
2	0.,		3.,	4 . 9	3*8.			001880	DI + X V A L 1129	
	SEEKER	SENSITIVITIES						001840	DT+XVALU30	

LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM - CONT'D (PAGE 8 OF 12)

C-10

001900 DT+XVALU31	016100	026100	001930	001040	026100	001960 DT+XVALU37		
FC THE ENLINMING CARD CONTAINS FALSE SEEKER SENSITIVITY VALUES TO	AVITO THE UDING CLASSIFIED MUMBERS IN THE PROGRAM LISTING.	THE CARPECT VALUES SHOULD BE RESTORED WHEN RUNNING IN A SECURE	ENVIRONMENT. PINS BINE WITH THESE FALSE VALUES ARE FOR EXAMPLE	PURPOSE ON Y	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 2 2 3 3 4 8 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5		FMD
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LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM - CONT'D

(PAGE 9 OF 12)

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CM+5 YMB0L3
CM+5 YMB0L3
SR-5 EPRC26
SR-5 EPRC26
SR-5 EPRC29
SR-5 EPRC10
SR-5 EPRC10
SR-5 EPRC11
SR-5 EPRC11
SR-5 EPRC11
SR-5 EPRC11
SR-5 EPRC15
SR-5 EPRC16
SR-5 EPRC16
SR-5 EPRC16
SR-5 EPRC26
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SR-5 EPRC36
                                                                        SR-SEPRC23
SR-SEPRC23
CM+LOGFLG2
CM+LOGFLG3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SR: SEPRC 43
SR: SEPRC 44
SR: SEPRC 45
SR: SEPRC 46
SR: SEPRC 46
SR: SEPRC 47
SR: SEPRC 49
SR: SEPRC 40
SR: SEPRC 50
SR: SEPRC 50
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SR: SEPRC 50
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                                                                                                     COMMON /LOGELG/ FIRSTL, SEGNML, SPCL(70), SHRTEC, FTSILL LOGICAL FIRSTL, SEGNML, SPCL, SHRTEC, FTSILL COMMON /SYMBOL/ BLANK, DECPMT, ALFRET(27), ANUMBR(11), SEP(5), 1 DOLLAR
                                                                                                                                                                                                                 DIMENSION A(N1), B(N2,N3), HCPR(10)
DIMENSION NC(80), PB(80,10), IC(80,10), NUMFLG(10)
                                                                SUBROUTINE SEPRC2 (A,N1,B,N2,N3)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SFPARATE RECORDS ON IMPUT CARD.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              TI 230
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   DO 180 1=63,72
IF (NC(1).NE.3) 69 TO 2.
CONTINUE
DO 190 1=79,80
IF (NC(1).NE.3) GO TO 2.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           (.NOT.FIRSTL) Gn TO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           (NC(I).NE.D) GO TO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DU 160 I=1,N1
160 NC(1)=IDCHAR(A,N1,I)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       (.NOT.SEGNML) GR
220 I=73,78
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               FIRSTL=.FALSE.
DO 170 I=73,78
IF (NC(I).NE.0)
                                                                                                                                                                                                                                                                                                                                                                                                                                                       130 1=1,912

DJ 130 J=1,913

130 8(1,4)=BLANK

DJ 140 J=1,90

140 P8(1,4)=BLANK

DJ 150 J=1,910
                                                                                                                                                                                                                                                                                 DO 110 I=1,10
NUMFLG(I)=0
DO 100 J=1,80
IC(J,I)=0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SEGNATE - TRUE - WRITE (6,330) WRITE (6,340) GD TO 210 IF (*MOT-SEGNAM
                                                                                                                                                                                                                                                                                                                                                                                                                 DO 120 I=1,80
NC(I)=0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DG 150 I=1
150 NCPR(I)=0
                                                                                                                                                                                                                                                                                                                                                                       CONTINUE
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     DO 190 I=
IF (NC(I)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     NC(I)=3
CONTINUE
CONTINUE
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LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM - CONT'D

COLUMN NUMBERS (READ VERTICALLY)

(PAGE 10 OF 12)

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SR-SEPRC66
SR-SEPRC67
SR-SEPRC67
SR-SEPRC70
SR-SEPRC73
SR-SEPRC73
SR-SEPRC75
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036490
036500
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            330 FORMAT (12H **PEFPHS** )109HNON-FATAL WARNING I YOU HAVE SEQUENCE 036560
INUMBERS IN COLS. 73-78 OF TAPE5. THEY WILL BE PEHOVED BY THE PROG036570
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     036580
340 FORMAT (12H **PREPNS** ,38H HOWEVFR, THF RESULTS MAY BF SUSPECT. 1036590
350 FORMAT (80A1)
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                                                                                                                                                                                                                                                                                                                                                                 036430
                                                                                            GO TO 240
IF (NC(I).Eq.3.OP.NC(I).Eq.4.OR.IW.NE.IX) GO TO 270
IW=IW+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      *** FORNAT STATEMFNTS ***
                                                                                                                                                                                                                                                                                                                                                                                              DD 320 I=1, MRE
KCHAR=HCPR(I)
ENCODE (80,350,B(1,1) )(PB(J,1), J=1,KCHAP)
320 CONTINUE
                                                                                                                                                                                                                                                                                                                                IF (NRE,GE,0.4HP,HRE,LE,10) GO TO 310
STOP * IN SEPRC2: ERROR NUMBER 1 *
                                                        ÎF (1.6T.N1) 60 TO 300
IF (NC(1).NE.3.NF.IW.NE.IX) 60 TO 260
                                                                                                                                                      IF (I.NE.(LSTCMA+1)) GO TO 280
                                                                                                                                                                                                                     GO TO 250
IF (MC(I), EQ.3) GN TO 250
                                                                                                                                                                                                                                                                                                                                                                      FUCUDE RECORDS INTO B APRAY
                                                                                                                                                                                                                                                        PB(J_JW)=A(I)
IC(J_JW)=NC(I)
NCPR(IW)=NCPR(IW)+1
60 T0 250
                                                                                                                                           GO TO 290
                                                                                                                                                                                                                                                                                                          CONTINUE
NRE≈IW
                                             LSTCMA=0
                                                                                                                                                                                                           LSTCMA=I
                                                                                                                                                                                                                                                                                                                                                                                                                                                                        RETURN
                                                                                                                                                                                              280 IX=IW
                                                                                                                                                                                                                                    290
                                                                                                                                                                                                                                                                                                            300
                                                                                 250
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                                                                                                                                                            270
                                                           240
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LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM - CONT'D (PAGE 11 OF 12)

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SR-NOREC 24
SR-NOREC 24
SR-NOREC 25
SR-NOREC 26
SR-NOREC 20
SR-NOREC 20
SR-NOREC 11
SR-NOREC 11
SR-NOREC 11
SR-NOREC 11
SR-NOREC 11
                                  SUBROUTINE MOREC2

WRITE (6,100)

RETURN

* * F D R M A T S T A T E H E H T S * * *

100 FORMAT (12H **PPFPMS** ,44H THIS IS A CPEATION RUN FOR RECORD OPTION 366720

INUMS )

END

036670

036720

036730
                              SUBPOUTINE NORECZ
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LISTING C-1 FORTRAN LISTING OF PREPMS PROGRAM - CONT'D

(PAGE 12 OF 12)

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LISTING C-2 SAMPLE INPUT FOR PREPMS (PAGE 1 OF 15)

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111111 000000 345678
000111 999000 789012
000000 999999 123456
000000 88889 567890
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3000000 777777 3345678
0000000 566677 7789013
0000000 666666 012345
000000 55555 456789
000000 445555 890123
000000 44444 234567
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0000000 1112222 7890123
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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 2 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 4 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 5 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 6 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D

(PAGE 7 0F 15)

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SAMPLE INPUT FOR PREPMS - CONT'D LISTING C-2

(PAGE 8 OF 15)

LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 9 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 10 OF 15)

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SAMPLE INPUT FOR PREPMS - CONT'D LISTING C-2

(PAGE 11 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 12 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 13 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D (PAGE 14 OF 15)

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LISTING C-2 SAMPLE INPUT FOR PREPMS - CONT'D

(PAGE 15 OF 15)

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LISTING C-3 SAMPLE RUNSTREAM FOR PREPMS

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3000,0000	.7500	.7000	.6500	.5000	• 6000	.0500
3500,0000	.7000	.6500	.6000	.4500	000000	0.0000
4000.0000	.6500	0009.	.5500	.4000	000000	0.0000
4500,0000	0009	• 5500	.5000	.3500	0.0000	0.000
5000,0000	.5500	. 5000	.4500	.3000	0000.0	0.000
5500,0000	. 000	. 4500	.4000	.2500	000000	0.000
0000.0009	•4500	.4000	.3500	.2000	000000	00000
6500,0000	.4000	.3500	.3000	.1500	000000	0.000
7000,0000	.3500	.3000	.2500	.1000	0000.0	00000
9000,0000	.3000	. 2000	.1000	0.000	000000	0.000
0.0000	30.0000	0000.00	150,0000	300.000	0000.0000	
. 5000	.7000	.5000	0008	. 7000	• 9500	. 6000
. 5000	0009.	. 4500	.7500	. 7000	1.0000	. 3000
* * * * *	* * * *	* * * *	* * * *	* * * *	***	***

LISTING C-4 SAMPLE OUTPUT FROM PREPMS (PAGE 1 OF 17)

8.0000	* * * * *	. 0140	
7. 0000	* * * * * * * * * * * * * * * * * * * *	7.0000	
.0220 .0110 .0220 .0220 .0220 .2120 6.0000	* * * * * *	0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000	1372.0000 0.0000
0,0000 0,0000 0,0000 0,0000 0,180 5,0000 014,0000	* * * * * * * * * * * * * * * * * * *	00000000000000000000000000000000000000	914.0000
0.0000 0.0000 0.0000 0.0000 4.0000 762.0000	* * * * * * * * * * * * * * * * * * *	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	762.0000 .3700
. 0040 . 0040 . 0040 . 0040 . 0040 . 11. 0000 610. 0000 0. 0000 0. 0000	* * 111 6900 0000	0.0000000000000000000000000000000000000	610,0000 .2600 1,0000
0.0000 0.0000 0.0000 0.0000 1.00000 457.0000 0.0000 0.0000	* * * * * * * * * * * * * * * * * * *	00000000000000000000000000000000000000	457,0000 .2200 .3900
0,0000 0,0000 0,0000 0,0000 1,0000 0,0000 0,0000 0,0000 0,0000	* * * * * * * * * * * * * * * * * * *	00000000000000000000000000000000000000	304.0000 .1500 1.0000

LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D (PAGE 2 OF 17)

: :	\$ \$ \$.0170	.0030																				0000							* * *				.0170	.0230
* * *	+ + +	.0280	.0140																				7.0000)))						* * * *			,	.1030	.0170
* * *	+ + +	0.000	000000		0,000.0	000000	000000	.0030	0210	.0070	.0210	.0350	.3390	0.0000	0000	0000	0.0000	0.000	•0030	•0030	00.00	0420.	6.0000	•	372,0000	.8500				* * * *			;	0.0000	0000000
**	T T T EING READ	.0170	.0030	0	0.0000	0.0000	0000.0	.0070	0000	.0030	.0070	000000	.0170	00000	0000	0000	000000	0000.0	• 0030	000000	0.0000	00000	5.0000	•	914.0000 1372.0000	.0500				* * * *	T HOW REING PEAN			.1360	.0130
**	F	000000	.0100	0	0.0000	0000.0	000000	0200.	0000	.0030	.0030	000000	.0030	00000	0000	0000	0.0000	000000	000000	000000	0.0000	• 0030	0.000.4			.1000				* * * *				.0330	000000
00000 **		00000.0	0.0000	.4060	0,000	0.000	0.000	0.000	0.000	0.0000	.0030	000000	.0100	0.0000	0000	00000	0.0000	000000	00000	0.000	.0030	00000	3.0000	11.0000	610,0000	0.0000	1.0000	0.0000	•	* * * *	7 3D 1200	***	0069*	. 0400	.0030
.2500	200021,1 D : JUN220	0.0000	0.0000	.0280	00000	000000	0.000	00000	0000.	0000	0.000	0.000	.0030	00030	0000	0000	0.0000	0.000	0.000	000000	0000	0000	2.0000	10.0000	457,0000	0.0000	1.0000	0.000	.0500	* * * *	609021,1 h : DECOAC		.2200	.0260	.0100
0.0000		.5200 .0100	.0350	.0100	0.000.0	0.000	000000	0.000	0000	0.000	000000	000000	.0030	0000	0000	0030	.0030	0000 0	0200.	00000	0.0000	0000	1.0000			00000	1.0000	0.000	.0500	* * * * * *	NEW RFG, DECO600021.1 PECHPD NAMED : DECO600021 DE TYPE	6 11	.7350	.0730	0200.

LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

(PAGE 3 OF 17)

		0000	* * *
		7.0000	* * * * *
.0170 .0030 .0100 .0100 .0300	. 0230 . 0100 . 0330 . 0300 . 0030 0 0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	1372.0000
.0030 0.0000 0.0000 0.0000 0.0130	. 0170 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	.0000 914,0000 1 .6600 .0900 . * * * * * *
0.0000 0.0000 0.0000 0.0000 0.0000	. 0070 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	~ ~
.0070 .0030 .0030 0.0000 .0200	. 0100 0.0000 0.0000 0.0000 0.0030 0.0030	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0130 11.0000	610,0000 76 0,0000 0,0000 0,0000 0,0000
.0070 0.0000 .0030 .0030 .0100	000000000000000000000000000000000000000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 10.0000	4,000 457,0000 0,000 0,000 0,000 ,2000 0,000 ,2000 0,000 ,2000 4,*** * * * * * * * * * * * * * * * * *
. 0400 . 0200 . 0230 . 0200 . 0460		0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	304.0000 0.0000 1.0000 0.0000 0.0000 * * * * * * * * * * * * * * * * * *

			.0670		.0230													
			.0030		.0100		0000.0	000000	• 0030	.0130	.0340	00000	0.00	.0130	.0230	.0230	.1440	
BEING READ			. 1040		.0070		.0070	000000	.0030	000000	.0070	0.0000	• 0200	0.0000	.0030	0.0000	• 0200	
NON T			.02.70		.0130		.0003	000000	.0030	0.0000	000000	000000	000000	000000	000000	.0030	.0170	
0021 OF TYPE		0069.	.0230	.2210	.0070	.2350	.0030					0000 • 0	000000			.0030	.0200	
: DEC140		.2200	.0200	.0340	.0030	.0230	.0030	.0100	0.0000	.0030	.0170	0000.0	02000	.0030	•0030	.0030	.0130	
RECORD NAMED: DEC1400021 OF TYPE 1 NOW	6 11	.6370	.0500	. 0470	.0200	.0070	.0340	0100	0010.	0010	. 0470	0.0000	.0340	.0200	.0100	0.0000	0.000	

.0130

LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

(PAGE 4 OF 17)

		00000000000000000000000000000000000000
8. O000	* * * * * * * * * * * * * * * * * * *	000000000 7777778 2345678°C
7.0000	* * * * * * * * * * * * * * * * * * * *)00000000000 566666677 3345678901
.0030 0.0000 0.0000 0.0030 0.0030 0.0030 0.030 0.030 1372.0000	* * * * * * * * * * * * * * * * * * *	00000000000000 555555666 3456789012
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 5.0000 5.0000	BEING READ 1230 1230 00000 00000 00170	000000000000 444444555 3456789012
. 0030 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0030 1.0340 4.0000 762.0000	* * * * * * * * * * * * * * * * * * *	0000000000 333333444 3456789012
. 0070 0. 0000 0. 0000 0. 0000 0. 0000 0. 0000 0. 0000 0. 0000 11. 0000 610. 0000 1. 0000 0. 0000	* * * * * * * * * * * * * * * * * * *	00000000000 222222333 3456789012
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0000 457.0000 457.0000 457.0000 6500		0000000000 1111111222 3456789012
. 0070 . 0030 . 0030 . 0030 . 0130 . 0130 . 0030 . 0030 . 0030 . 0030 . 0000 . 0000 . 0000 . 0000 . 0000 . 0000 . 0000	* O Z	0000000000000 00000000111 123456789012

LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D (PAGE 5 OF 17)

12345678901	111111122 2345678901	22222233	3333333344 2345678901	444444445 234567890]	55555555666 123456789012	6666666777 3456789012	000000000011111111112222222333333333444444444555555556666666666
1.0000	1.0000 2.0000	3.0000	4.0000	5.0000	5.0000 6.0000	7.0000	8.0000
0000.6	10.0000	11,0000					
304,0000	457.0000	610,0000	762,0000	610,0000 762,0000 914,0000 1372,0000	1372,0000		
00000	000000	0.000	.8200	.0700	.1100		
1.0000	.4700	1.0000					
0.000	.2500	000000					
0.0000	.2800	000000					
0.000	1.0000						
**	* * * * *	***	* * * *	* * * * * .	***	* * * *	* * *
NEW REC, ACQUATO122,2	10'AT 0122,2	:					

	. 7000		4300.0000	. 7000		420.0000		400.0000		620,0000		420,0000		490.0000					* * *				. 7000		2500.0000		• 7000		180,0000		200,0000		240.0000		
	• 6000		3900,0000	. 6000		300,0000		360,0000		480.0000		380,0000		390.0000					* * * * *				• 6000		2000.0000		• 6000		140,0000		150,0000		210,0000		
ē	.5000		3400.0000	.5000		230,0000		300.000		4000.0000		320.0000		330,0000					* * * * * .		ē		• 5000		1600,0000		.5000		120.0000		120,0000		10000000		
BEING READ	. 4000		2900.0000	4000		150,0000		230.0000		230.0000		210,0000		250,0000		0000.6066			* * * * .		BEING READ		. 4000		1300.0000		• 4000		70.0000		70.n000		140.0000		
TYPE 2 NOW	.3000		2300,0000	3000		90,000		130,0000		130,0000		130,0000		170,0000		2500.00000			* * * *		TYPE 2 NOW		.3000		0000.000		.3000		50.0000		50.0000		100,0000		
ACGDATO122 OF T	.2000	1.0000	1500.0000	2000	1,0000	70,0000	1400.0000	70.0000	980.0000	70.0000	1600.0000	70.0000	980.0000	100.0000	1425.0000	2000,0000			* * * *		ACQUATO222 OF T		.2000	1:0000	650,0000	7000.0000	.2000	1.0000	40.0000	1100,0000	40.0000	1520,0000	60.0000	1600.0000	0000 66666
r	•	0006.	0000.000	1000	0006	40.0000	1140,0000	40.0000	670.0000	40,0000	1330,0000	40.0000	570,0000	50.0000	950,0000	1500,0000	3,0000	2.0000	*	RFC, ACQDAT0222,2	••	۳	.1000	0000	400.0000	3700.0000	.1000	0000.	30.0000	500.0000	30.0000	0000.000	40.0000	290.0000	2500.0000
RECORD NAMED	0.0000	.8000	00000		8000	25.0000	580.0000	25.0000	500.000	25.0000	1 0000 0000	25.0000	460.0000	25.0000	720.0000	1 000.0000	5.0000	3,0000	* * * * *	NEW RIC, ACQ		11 11	000000	0003.	0.000	3000,0000	000000	.8000	25.0000	280,0000	25.0000	420,0000	25.0000		2000.0000

2,0000

3.0000

LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

(PAGE 6 OF 17)

COLUMN NOS.			
111111111111	011111111111	1901234567890	
0000011111111)0000000066666	56789012345678	
00000000000000	R 88 8 8 9 9 9 9 9	2245478001234	1631010101163
	000000000000000000000000000000000000	00000111111111222222222233333334444444444	7069/964977068
	200000000000000000000000000000000000000	200000000000000000000000000000000000000	24789012343676
		*****	245678901734
	000000000000000000000000000000000000000	2333333333444	100073775000
	0000000000000	111222222222	707 72 / 50 700
	000000000000	000001111111	111111111111111111111111111111111111111

0000000 777777 2345678	计专件 计非非计算 计计算 计计算 计计算 计计算 计计算 计计算 计计算 计计算 计	NEW RECARCOBATO322,2 RECORD NAMED : ACGDATO322 OF TYPE 2 NOW BEING READ	1 .0200 2000.0000 300 .1000	.8000 .0000 1.0000 25,0000 40,0000 70,0000 130,000 230,0000 400,0000 480,0000 620,0000 1000,000 1330,0000 1600,0000	0000 0000	DATO223,3 FD : RSPDATO2	0000 .1250 .2500 .3750 .5000 .6250 .7500 .8750	0000 0000 5.0000 10.0000 18.0000 24.0000 36.0000 52.0000 87.0000	45.0000 20.0000 54.0000 97.0000 25.0000 6.0000 37.3700 27.6700 6.0000 6.9000 6.9000 5.9500 15.7200 32.9200 37.1300 6.9000 6.9000 6.9000 5.9500 175.0000 89.0000	* * * * * * * * * * * * * * * * * * *	8	T0124,4 : DFSDAT0124	8 0000 500.0000 1000.0000 1500.0000 2000.0000 3001.0000 9999.0000 0.000	0999,0000 0.0000 0.0000 0.0000 * * * * * * * * * * * * * * * * * *	ᲘᲘᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘᲡᲡᲘᲡᲘᲡᲘᲡᲘᲡᲘ
00000000000000000000000000000000000000	* * * * *	NEW REC, ACQDA	8 11 0.0000 0.0000 20 0.0000	25,0000 1000,0000 13	0000°6666 0000°6 2°0000	NEW RECORD NAME	000000	1.0000	174,0000 45,0000 17,3700 13,5700	* * * * * * NEW RFC.PSTD	8 0000.0 0000.0 0000.0 0000.0	NEW RECORD NAMED	8 0.000 0.000 1.000 * * * * * NEW PFC, DFSD RECUPE MAME	2 0.0000 0.0000 0.0000 * * * * * 0PTION WORD	00000000000000000011 12345678°01

LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

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                                                                                                                                                                                                                                                                                                                                                                       BEING INPUT
                                                                                                                                                                                   BEING INPUT
                                                                                                                                                                                                                                                                                BEING INPUT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              OPTUDS,TARGETTYPE,7,14
OPTION WORD TYPE RECORD HAMED: TARGETTYPE BEING THPUT
7 OPTION CARDS READ FOR KEYWORD HUMBER 14
                                                                                               r.
                                                                                                                                                                               OPTION WORD TYPE RECORD NAMED: LOSMODE
4 OPTION CARDS READ FOR KEYNORD NUMBER 11
1,2,5HOOTINGGALLERY
                                                                                                                                                                                                                                                  OPT WNS,PLOT,4,5
OPTION WORD TYPE RECORD HANED : PLOT
4 OPTION CARDS READ FOR KEYWORD HUMBER.
4 OPTION CARDS PEAD FOR KEYWORD HUMBER 1, 2, RESETDEFAULTS
                                                                                                                                                                                                                                                                                                 1, 2, PP IOR ITYPRFPLANNED TARGET
                                                                                                                                                                                                                                                                                                                                     2, 2, PPT
3, 2, TARGETOFOPPOPTUNITY
                                                                                                                                                                  OPT WDS, LOSNODE, 4, 11
OPTION WORD TYPE REC
                                                                                                                                                                                                                             2, 2, RANDOMOCCURRENCE
2, 2, RO
                                                                                                                                                                                                                                                                                                              1, 2, PPPT
2, 2, PPEPLANNED TARGET
                       1, 2, P.D
2, 2, DON'T RESET
                                                                                                         1, 2, PPINTER
                                                                                                                    2, 2, CALCOMP
                                                                                                                                                                                                                                                                                                                                                                                                                        1, 2, THPEE
                                                                                                                                1, 3, 0FF
2, 3, 0N
                                                                                                                                                                                                                                                                                                                                                                                                                                             2, 2, TWO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  5, 2, 5
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LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

(PAGE 8 OF 17)

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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      BEING INPUT
                                                                                                                                                                                                                                                                         OPTUDS, TLEFACTORS, 1,33
OPTION WORD TYPE PECORD NAMED: TLEFACTOPS BEING INPUT
I OPTION CARDS READ FOR KEYWORD NUMBER 33
                                                                                                                                                                                                                                                                                                                                                             OPTION WORD TYPE RECORD NAMED : ACQPINGUIST BEING INPUT
8 OPTION CARDS READ FOR KEYWORD NUMBER 22
                                                                                                                                                                          OPIIDH WORD TYPE FECORD NAMED : FOPOSITION BEING INPUT
4 OPIION CARDS READ FOR KEYWORD NUMBER 17
                  OPTUDS,DESIGTYPE,6,16
OPTION WORD TYPE RECORD HAMED : DESIGTYPE BEING INPUT
6 OPTION CARDS READ FOR KEYWORD HUMBER 16
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           OPTUDS, RESPIIME, 15,23
OPTION WORD TYPE RECORD HAMED : RESPTIME
15 OPTION CARDS READ FOR KEYWORD NUMBER 23
                                                                                                                                                                                                                                                                                                                             OP TWDS, FOPOSITION, 4,17
                                                                                                                                                                                                                              1, 2, VP
2, 2, MATIE UVER. UNIT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     4 * * * * * *
                                                                                                                                                                                                              1, 2, VANTAGEPOINT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              3, 2, SC UNG ID
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              11,2,P
1,3,PIGITAL
                                                                                                                                                                                                                                                                                                                                                                                                   1, 2, AVERAGE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 1, 2, FTSILL
              * * *
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          2,2,STAUCH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                11,2,PAPAM
                                                                                                                                                                                                                                                                                                                                                                                                                           2, 2, CL NSE
2, 2, C
                                                                                                                                                                                                                                                                                                                                                                                                                                                       3, 2, OPEN
3, 2, O
4, 2, STAGS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     2, 3, VHICE
                                                                     1,2,6LLD
                                                                                               2, 2, MULF
                                                                                                                                                       * * *
                                                                                                                            3, 2, LTP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            15
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LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

COLUMN NOS.

(PAGE 9 OF 17)

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0.0000
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                                                                                           87,0000
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                                                                                                                                                                                                                                                                                                                                                           52,0000
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                                                                                                                                                                                                                                                                                                                                                                                     0.0000
                                                                                                                                                                                                                                                                                                                                        .6250
                                                                                                                                                                                                                                                                                                                                                         36,0000
                                                                                                                                                                                                                                                                                                                                                                                                                 *
                                                                                                                                                 OPTION WORD TYPE RECORD NAMED: DEIDESUPPE BEING INPUT
4 OPTION CARDS READ FOR KEYWORD NUMBER 24
                                                                                                                                                                                                                                                                                                                                                                                                                 *
                                                                                                                 BEING INPUT
                                                                                                                                                                                                                                          BEING INPUT
                                                                                                                                                                                                                                                                                                                    BEING READ
                                                                                                                                                                                                                                                                                                                                                                                                                                   5 MOW BEING READ
                                                                                                                                                                                                                                                                                                                                                                                                                 * * * •
                                                                                                                                                                                                                                                                                                                                                                                   0.0000
46.3200
75.0000
                                                                                                                                                                                                                                                                                                                                       . 5000
                                                                                                                                                                                                                                                                                                                                                       24.0000
                                                                                                                                                                                                                                                                                                                                                                           0.000
                                                                                                                                                                                                                           OPTUDS, SMOKE, 4, 32
OPTIOP WORD TYPE PECORD HANFD : SMOKE
4 OPTION CARDS READ FOR KEYWORD HUMBER 32.
                                                                                                                          3
                                                                                                                                                                                                                                                                                                     NEW RECARSPDATO123,3
PFCOPD NAMED : RSPDATO123 OF TYPE 3 NOW
                                                                                                                                                                                                                                                                                                                                                                                  0.0000
69.1900
75.0000
                                                                                                                                                                                                                                                                                                                                     .3750
                                                                                                             OPTION WORD TYPE PECORD NAMED: RUMC
2 OPTION CARDS READ FOR KEYWORD NUMBER
                                                                                                                                                                                                                                                                                                                                                       18.0000
                                                                                                                                                                                                                                                                                                                                                                           0.0000
                                                                                                                                                                                                                                                                                                                                                                                                                 * *
                                                                                                                                                                                                                                                                                                                                                                                                                              RECOPP NAMED : RODAV3TRNI OF TYPE
                                                                                                                                                                                                                                                                                                                                                                                                              * * * * *
                                                                                                                                                                                                                                                                           2, 2, PROBABILITYSHOKEKILLSMISSION
2, 2, PPBSHOKF
                                                                                                                                                                                                                                                                                                                                                                                           69.1900
                                                                                                                                                                                                                                                                                                                                     .2500
                                                                                                                                                                                                                                                                                                                                                       10.0000
                                                                                                                                                                                                                                                                                                                                                                         20.0000
                                                                                                                                                                                                                                                                                                                                                                                    0.0000
                          OPT WDS, DFIRESUPPR, 4,24
                                                                                                                                                                                                                                                                                                                                                                                  0.0000
69.1900
                                                                                                                                                                                                                                                                                                                                                                                                              * *
                                                                                                                                                                                                                                                                                                                                     .1250
                                                                                                                                                                                                                                                                                                                                                     5.0000
                                                                                                                                                                                                                                                                                                                                                                       20.0000
                                                                                                                                                                                                                                                                                                                                                                                                     75.0000
                                                                                                                                                                                                                                                                                                                                                                                                                     NEW REC, RUDAV3TRN1,5
                                                                                                                                                                                                                                                                                                                                                                                                              * *
                                                                                                                                                                                                                                                                   1, 2, SMKRINDS
                                                                                                                                                                                                                                                                                                                                           1.0000
                                                                                                                                                                                                                                                                                                                                                                                0.0000
                                                                                                                                                                                                                                                                                                                                   000000
                                                                                                                                                                                                                                                                                                                                                                      20,0000
                                                                                                                                                                                                                                                                                                                                                             174.0000
                                                                                                                                                                                                                                                                                                                                                                                                    75.0000
2, 4, NI GHT
                                                                         2, 2, NUME
2, 2, N
                                                       1,2,HIGH
                                                                                                                                                                                                           2, 3, LnnG
                                                                                                                                1,2,ND
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LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

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LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

15.0000

15.0000

.7580 * * * * * * * * * * * NEW REC, RODAV8TRN3,5	 	* * *	* * * *	* *	* *	* *	* *	
RECORG MAMED 1	1ED : RODAVBTRN3	10	TYPE F NOW	BFING READ	6			
15.0000 9999.0000								
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RECOPD NAMED	7041032333 IED : RSPDA	USCS)3 : ESPDATO323 OF TYPE	үре з июм	BFING READ	6.			
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LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

(PAGE 12 OF 17)

(PAGE 13 OF 17)

LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

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LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

(PAGE 14 OF 17)

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LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

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			0.000	.0070	0.0000	0.000	0.000	• 0030
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LISTING C-4 SAMPLE OUTPUT FROM PREPMS - CONT'D

(PAGE 16 OF 17)

- CONT'D SAMPLE OUTPUT FROM PREPMS LISTING C-4

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C-47

APPENDIX D

LISTING AND SAMPLE CASE OF COPE

APPENDIX D

LISTING AND SAMPLE CASE OF COPE

This appendix contains:

- (1) A listing of the FORTRAN code for the COPE program.
- (2) One set of sample case inputs for COPE.
- (3) One sample runstream for COPE.
- (4) Sample output created by running COPE with the sample input (and with the TAPEll created by previous PAM and PREPMS sample case runs). The output produced on TAPE8 by this run (for cases 1 and 2) is included in Listings 7-1 and 7-2 of section 7.6.

Note: The column numbers included in some of the listings in this appendix are not a part of the program code, the data, or the output, but are included only for the reader's convenience.

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PR-COPE 3
PR-COPE 4
PR-COPE 6
PR-COPE 10
PR-COPE 11
PR-COPE 11
PR-COPE 12
PR-COPE 13
PR-COPE 13
PR-COPE 14
PR-COPE 13
PR-COPE 20
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                                                                                     -TAPES (INPUT) IS THE I/O UNIT FPON WHICH THE INPUT DIRECTIVES

ARE PEAD. IT IS ALSO USED WHEN THE "TEMPORARY" OPTION IS USED TO 00203

READ FORMATED LIPUT.

-TAPE 4 IS AN ALTERNATE INPUT FILE THAT MAY BE USED WHEN READING PE 00200

DATA WHOER THE "TIMPORARY" OPTION.

IT IS USUALLY THE FILE TO WHICH THE NORMAL OUTPUT: SWRITTEN. 00211

IT IS ALSO EQUATED TO DEBUG SO THAT SURROUTINE PACEBACKS WILL BE 00211

PRINTED ON IT.

-TAPE IS NOT CURENTLY USED. IT JS INTENDED AS THE FILE TO WHICH 00210

OUTPUT WILL BE WITTEN FOR USE BY A POSSIBLE FUTURE COPE ANALYSIS 00211

PROGRAM.

-TAPES IS THE FILE TO WHICH PRINTS ("DATA CHECKS") ARE 00211

WEITTEN. UMLESS USER ACTION IS TAKEN, IT IS TREATED AS A SCRATCH 00221

-TAPE IS THE FILE TO WHICH PRINTER PLOTS WILL BE 00221

-TAPES IS THE FILE TO WHICH THE CALCOMP PLOT OUTPUT WILL BE 00221

WRITTEN IF AND WHEN THAT PLOT OPTION IS IMPLEMENTED.

-TAPES IS THE FILE TO WHICH THE CALCOMP PLOT OUTPUT WILL BE 00222

-TAPES IS THE FILE TO WHICH THE CALCOMP PLOT OUTPUT WILL BE 00222

WRITTEN IF AND WHEN THAT PLOT OPTION IS IMPLEMENTED.

-TAPES OF SECRIFED IN THE DOCUMENTATION. TAPELL IS CREATED BY 00222

HHICH COPE OBTAINS THE DATA RECORDS USED TO TAPELL IS CREATED BY 00222

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HHICH PREPAS AND PAUL PREPADOLESSORE THE FEAD OF 00222
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LOGICAL DOKILD
COMMON /FLAG/ FNDPEP, IDH, IPFEPL, IDIGIL, IPFTY, IPNDAC, IT3FLG,
PROGRAM COPE (INPUT, OUTPUT, TAPES=INPUT, TAPE6=DUTPUT, NERUG=OUTPUT, TAPE4, TAPE7, TAPE8, TAPE9, TAPE10, TAPE11)
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LOGICAL ENDELG, ENDREP
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 CALL INITLZ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               CALL REINTZ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     100 CALL INPUT
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM

82)

(PAGE 1 OF

9 COLUMN NUMBERS 3 (READ VERTICALLY)
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                                                                                                                                                                                                                                                                                                                      IF (IPNDOC.EQ.O) CALL TINCHK
IF (ENDREP) GO IN 140
    BEGIN "REPLICATION" LOOP
                                                                      CALL ARTCHK
IF (FNDREP) 60 TO 140
                                                                                                                        CALL VISCHK
IF (ENDREP) GO TO 140
                                                                                                                                                                     CALL DETCTN
IF (FHDREP) 60 TO 140
                                                                                                                                                                                                                CALL DUST
IF (EMDREP) 60 TO 140
                                                                                                                                                                                                                                      IBAJL=1
CALL BLUCHK
IF (EHDREP) GO TO 140
                                                                                                                                                                                                                                                                                        IBAIL=2
CALL BLOCHK
IF (FNDREP) GO TO 140
                                                                                                                                               CALL RNGCHK
IF (ENDREP) 60 TO 140
                                                                                                                                                                                          CALL SMOKE
IF (ENDREP) GO TO 140
                                                                                                                                                                                                                                                                   CALL GETTIM
IF (ENDREP) 60 TO 140
                                                                                                                                                                                                                                                                                                                                                                       120 CALL LOSCHK
IF (ENDREP) GO TO 130
                  110 KPF=1
TIMHOW=0.0
TIMHA 0.0
ENDREP=-FALSE.
NVEHKL=0
                                                                                                                                                                                                                                                                                                                                                          BEGIN "POUND" LOGP
                                                      DUKILD - . FALSF.
                                                                                            CALL GETVIS
                                                                                                          CALL GETRNG
                                                                                                                                                                                                                                                                                                                                            CALL ADDIOF
                                                                                                                                                                                                                                                                                                                                                                                               CALL WARNED
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 2 OF 82)

CALL DECHK TF (FINDED) GN TN 130	0.000		
CT TO	040500	PR-COPEIOS	
)	003070	PR-COPE110	
	06000	PR-COPELL2	
IF (ENDREP) GO TO 130	003100	PR-COPE113 PR-COPE114	
	003120	PR-COPE115	
IF (INDREF) 6U (U 130	003140	PR-COPE117	
CALL PECHK	003150	PR-COPE118	
	003170	PR-COPE120	
CALL HITCHK	003180	PP-CUPEIZI PR-CUPE122	
	003500	PP-COPE123	
CALL PKCIK	003210	PR-COPE124	
130 TF (WDE EQ NDE) CD TD 160	003220	PR-COPE125 PR-COPE126	
	003240	PR-C 0P E127	
CALL ADDTBR	003250	PP-COPE128	
	003560	PR-CUPELZ9	
KKT=KKT+1 FNDBFD= FAINF	003280	PR-COPE130	
60 TH 120	003290	PR-COPE132	
	003300	PR-COPE133	
FND "ROUND" LOOP	003310	PR-COPE134	
140 IF (KREP.FO.MPEP) 60 IO 150	00 3330	PR-C0PE136	
	003340	PR-C0PE137	
60 TO 110	003350	PR-COPE138	
FND "REPLICATION" LOOP	003360	PR-CUPEL39 PR-CUPE140	
	003380	PR-C0PE141	
150 CALL OUTPUT	068600	PR-CUPE142	
TE (.NDT.ENDFIG) GO TO 100	003400	PR-CUPE143 PR-CUPE144	
	003450	PP-C0PE145	
END "CASE" LOOP	003430	PR-C0PE146	
	003440	PR-COPE147	
STOP ' IN COPE: NORMAL PROGRAM TERMINATION '	003450	PR-COPE148	
	003450	PR-C 10F150	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 3 OF 82)

	003490	80-8DATA12	
CO. CATORICA A IN INCIDENCE OF	003200	BD-8DATA13	
COMMON JACKAR COLVINABLICATA) HER	000130	CM+ABRLBL2	
COMMON / DESENS / DESENS (2-2)	000120	CM+ACHAR 2	
COMMON ADISPLY DISPLOSATION DECEMBERS THE DELEN	017000	29 N. C. L. C. L. C.	
	000360	CM+ELTTM2	
COMMON /FSRESP/ FSRT(14,2)	000360	CM+FCDECD2	
COMMON /HEADNG/ ACQLBL(2,4), DAYLRL(2), DFSLBL(2), DGTLBL(2,2),	000380	CM+HFADNG2	
1 DOLBL(3,2), ROLBL(4,2), RSPLBL(3,3)	000390	CM+HEADNG3	
COMMON /LOGFLG/ FIRSTL, SEQUML, SPCL(70), SHPTEC, FISILL	000510	CM+L DGFL G2	
LUGICAL PIRSTL, SEMPLE, SPCL, SHRIEC, FISIL	000520	CM+L06FL63	
1PUINT(70)	009000	CM+POINT 2	
CONTROL SHEET SHEET SHEET SHEET BY SHEET BY SECTION OF THE NEWEST NEWEST	000050	CM+SMOKED2	
COMMON STITLE STUEDS, VEFDATION	000030	CM+SMOKED3	
	000000	CM+SITIFEC	
	000080	CM+SYMBOL3	
COMMON /XVALUE/ XVALUF(8,9,2)	001100	CM+XVALUE2	
+	003640	RD-BDATA17	
;	003650	ED-BDATA18	
	003660	BD-BDATA19	
-	003670	BU-BUAIA20	
NITOROFILIBOLETERS/PORTS////////////////////////////////////	003680	BO-BOATA21	
	003690	00-00AIA22	
3 10HTARGET BEY-10HOND DESIGN-10HATOR PANCE.	003500	BU-BUALAZ3	
	003720	RD-RDATA25	
	003730	60-80AIA25	
	003740	BD-BDATA27	
10HDESIGNATOR, 10H BAILED-OU, 10HT	003750	BD-BDATA28	
O TOMEDBOD IN TITOURANGUETT JOHN	003760	BD-BDATA29	
+	003770	BO-BDATA30	
-	003780	BU-BUALA31	
-	067500	50-60AIA32	
-	003800	BD-BDAIA33	
IOHDESIGNATUR, 10H IN DIRECT, 10H FIRE	003820	8D-8DATA35	
_	003830	BD-BDATA36	
Н,	003840	BD-BDATA37	
TOHERTOND DID FIGHTHUT ENGA	003820	BD-BDATA38	
TOURUND ENGA, TOURSED BUT	003860	BD-BDATA39	
	003870	BD-BDATA 40	
	003880	BD-BDAIA41	
C * * * * FILL IN ACHAP COMMON BLOCK * * * *	003890	BD-BDA1A42	
	003910	80-80ATA44	
	003920	BD-BDATA45	
1. Out of the IRS ICASE 57*IH	003630	P.D-BDATA46	
j m	003940	BD-BDATA47	
4 3.90.910ffEND 27*111 9	049500	80-80A1A48	
	003970	BD-BDATA50	
4010HFNDF .7*1H .	00000	DD-DDATAE1	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 4 OF 82)

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80-80ATA79
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6D-80AT103
8D-80AT104
8D-80AT105
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BD-BDATA99
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BD-BDATA71
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BD-BDATA69
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BD-BDATA82
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BD-BDATA84
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80-8DATA88
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BD-BDATA90
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BD-BDATA92
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80-80ATA58
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22.,8.,10HACQRNGFIST,7*1H ,
52.,8.,10HACQRNGFIST,7*1H ,
52.,10.,10HESPOTIME ,7*1H ,
7 24.,4.,10HDIRECTTIRE,10HNE ,7*1H ,
8 24.,4.,10HDIRECTTIRE,10HSUPPRESSIG,10HN ,5*1H ,
9 25.,0.,10HRANDOMOCCU,10HRFREENEEPIST,10HRIBUTION ,5*1H ,
A 25.,0.,10HREDATA ,7*1H ,
C 27.,4.,10HREGETPOTST,10HUREDISTRIB,10HUTION ,5*1H ,
C 27.,4.,10HTGFPOTST,10HUREDISTRIB,10HUTION ,5*1H ,
E 28.,0.,10HIAVARIANT,7*1H ,
                                                                                                                                                                                                                          1 11.54.,10HLINEGFS15H,10HTMOPF ,6*1H ,
2 11.54.,10HLDSMDE ,7*1H ,
3 12.56.,10HMISTSTETC ,7*1H ,
5 13.54.,10HMISTSTETC ,7*1H ,
5 13.54.,10HWINBEF GFDI,10HFFRF HTTAP,10HGFTP GSTURE,1HS,4*1H ,
6 13.54.,10HUMDITTGTP,7*1H ,
7 14.75.,10HTSTGTTPF,7*1H ,
8 16.56.,10HDESIGTYPE ,7*1H ,
A 17.54.,10HDGSIGTYPE ,7*1H ,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  DATA ((CHAR(I<sub>5</sub>J), I=1,10), J=40,55),
1 41.,0.,10HDDARTILLER,10HYPR
2 41.,0.,10HDDARFK
3 42.,0.,10HDARFK
5 43.,0.,10HTARGETVEL 0,10HCTTY
6 43.,0.,10HMAXTHUMDES,10HIGHATORFAH,10HGE
6 43.,0.,10HMAXTHUMDES,10HIGHATORFAH,10HGE
7 44.,0.,10HBAILDUTRAH,10HGF
8 44.,0.,10HBAILDUTRAH,10HGF
9 45.,0.,10HTMEOFFLIG,10HHT
A 45.,0.,10HTMEOFFLIG,10HHT
A 45.,0.,10HTMEOFFLIG,10HHT
C 47.,0.,10HTMEOFFLIG,10HHT
C 47.,0.,10HTMEOFFLIG,10HT
EOFFLIG,10HT
C 47.,0.,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10HTMEOFFLIG,10
                                                                                                                                                                                                                        , 6*1H
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DATA ((CHAR(I,J),I=1,10),J=38,39)/
1 31.,0.,10HRUMC ,7*1H ,
2 32.,4.,10HSMOKE ,7*1H /
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          DATA ((CHAR(I,J),I=1210),J=24,37)/
21,10,10,10HWEATHER, ,7*1H, ,
21,10,10,10HW
                                                                                                                                                                                               DATA ((CHAR(I,J),I=1,10),J=14,23)/
.11,94,10HLINEOFSIGH,10HTHODF
.11,94,10HLOSHODE ,7*1H ,
.12,66,10HMISSIGHIOD,10HE
                   8 6.0.0.10HOVERIDF 774HH;

9 6.0.10HOVERIDF 774HH;

A 7.0.10HOVERIDF 774HH;

B 7.0.10HTEMP 774HH;

C 8.0.10HTEMP 774HH;

C 8.0.10HTEMP 774HH;
       5., 4., 1 OHPLOT
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 5 OF 82)

COLUMN NUMBERS (READ VEPTICALLY)

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60-80A1109
80-80A1110
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80-80AT147
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80-8DAT152
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80-80AT154
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80-80AT156
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                       F 48.,0.,10HPRBVACTEAN, 7*1H , 004540 6 40.,0.,10HPRAHSABILIT,10HYDFSUCCESS,10HFULDIGITAL,10HTRAHSMISSI,10004550
                                                                                                     004560
                                                                                                                                                                  004580
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DATA (DISPM(I), I=1,4) /3HJUH, 3HDFC, 3HMAR, 3HSEP/
DATA (PECLBL(I), I=1,4) /1H; 6HACODAT, 6HPSPDAT, 6HDSPAT, 5HPODAVOS510
DATA (PECLBL(I), I=1,8) /5HMDATA, 6HPSPDAT, 6
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      2600004940
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            DATA ((DESRHG(I,J),I=1,3),J=1,2) /7000., 7000., 3500., 2600.,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ,5*1H ,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  , 5*1H ,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ,5*1H
                                                                                                                                                                                                                                                                                                                                                                                                                                      ,5 * 1H
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         60.,0.,10HSEEKSENS ,7*1H ,61.,0.,10HPMESSARE ,5*1H
61.,0.,10HPROBCORMS6,7*1H ,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            * * * * FILL IN DESPNG COMMON BLOCK * * * *
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                                                                                                                                                                                                                                                                                                                                                                                                                                                             53.,0.,10HNUMRNDS ,7*1H ,
54.,0.,10HNUMBERGFVE,10HHICLESPERT,10HARGET
                                                                                                                                                                                             AATA ((CHAR(I,J),I=1,10),J=56,73)/
50.00.10HRDTULIFILI,JUHGHTPFLIARI,10HLITY
50.00.10HRDFLFFE, 771H,
51.00.10HTHFRFTWEF,10HNPGHNES ,6*1H,
                                                                                                                                                                                                                                                                                                                          51.,0.,10HTRR ,7*1H , 52.,0.,10HHUNBER.OFRE,10HPLICATIONS,6*1H ,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              54.90.,10HNUMVEHTGT ,7*1H ,
55.,0.,10HDISTANCEBE,10HTWFENVEHIC,10HLFS
55.,0.,10HDISTBVEH ,7*1H ,
56.,0.,10HGUNTARGETR,10HANGE ,6*1H ,
                                                                                                                                                                                                                                                                                                                                                                                             52.,0.,10HNUHREF ,7*1H ,
53.,0.,10HNUMBEPOTRO,10HUNDSTOREFI,10HRED
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          , HI#9
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59.00,10HTAGETHEAD,10HTHG
59.00,10HTGTHRG ,7*TH .
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           F 57.,0.,10HREFLECTIVI,10HTY
6 57.,0.,10HREFLECT ,7*1H ,
H 58.,0.,10HDEFLECT ,7*1H ,
II 58.,0.,10HDEFLE ,7*1H ,
                                                                                              10N 341H 9
49.90.910HPRBDGTTRAN9741H /
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 6 0F 82)

COLUMN NUMBERS (READ VERTICALLY)

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8D-8DAT188
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BD-BDAT190
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BD-BDAT192
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001480
DATA ((ACQLBL(I,J),I=1,2),J=1,4) /IOHAVERAGE TE, 5HRRAIN, 10HCLGSE005170

1 TERR, 3HAIH, 10HOPEN TERRA, ZHIN, 10HSTAGS TERR, 3HAIH/ 005100

DATA (DAYLBL(I),I=1,2) /8HDAY TINE, 10HNIGHT TIHE/ 005200

DATA (DESLBL(I),I=1,2) /4HHIGH, 4HNONE/ 005200

DATA (DGTLBL(I),I=1,2) /4HIGH, 4HNONE/ 005210
                                                                                                                                                                                                                                                       10MM, 1HO/
DATA ((DOLBL(I,J),I=1,3),J=1,2) /10HDESIGNATOR, 10H AT VANTAG, 7HE005290
DATA ((DOLBL(I,J),I=1,3),J=1,2) /10HDESIGNATOR, 10H AT VANTAG, 7HE005240
I POINT, 10HDESIGNATOR, 10H WITH MAME, 10HUVER UNIT / 005250
DATA ((ROLBL(I,J),I=1,4),J=1,2) /10HCONTINUOUS, 10H LOS ("SHD, 10H005260 10TING GALL, 5HERY"), 10HBROKEH LOS, 10H ("RANDOM", 10HOCCUPRENCE, 005270 25H")/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DATA (((SMK2(I,J,K),I=1,3),J=1,3),K=1,2) /1936., 376., 220., 0., 8005410
126., 0., 0., 1220., 0., 1260., 280., 178., 0., 530., 0., 0., 826.,005430
005430
                                                                                                                                       005160
                                                                                                                                                                                                                                                                                                                                                    DATA ((RSPLRL(I)J))1=1,3),J=1,3) /10HPRE-PLANHE, 10HD TARGET , 1H005290
I , 10HTARGET OF , 10HOPPORTUHIT, 1HY, 10HPRIORITY P, 10HRE-PLANNED005300
                                                                                                                                                                                                                                                                                                                                                                                     005310
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       * * * *
                                                                                                                                     * * * * * FILL IN HEADNG COMMON BLOCK * * * * *
                                                                                                                                                                                                                                                                                                                                                                                                                        * * *
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         * * * * * FILL IN SYMROL COMMON BLOCK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      FILE IN STITLE COMMON BLOCK
                                                                                                                                                                                                                                                                                                                                                                                                                       * * * * * FILL IN LOGFLG COMMON BLOCK
                                                                                                                                                                                                                                                                                                                                                                                                                                                       DATA FIRSTL /.TRUE./ , SEQUML /.FALSE./
DATA (SPCL(I).I=1,70) /70*.FALSE./
DATA SHRTEC /.TRUE./
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        * * * * * FILL IN POINT COMMON BLOCK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DATA BLANK / 1H / , DFCPHT / 1H./
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DATA FRONT /12.0/
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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(PAGE 7 OF 82)

	DATA ALFRE 1, 1HL, 1HM	1 /1814, 1, 1818,	1HB, 1 1H7, 1H	.HC, 1HP 1P, 1HQ,	, 1885, 1889, 18	1HF, 1HC HS, 1HT,	3, 18H,	DATA ALFRET /1HA, 1HB, 1HC, 1HP, 1HE, 1HF, 1HG, 1HH, 1HI, 1HJ, 1HK001520 1, 1HC, 1HM, 1HM, 1HM, 1HT, 1HP, 1HP, 1HP, 1HF, 1HT, 1HU, 1HW, 1HX,001530	LHK 001520 4X, 001530	DT+SYMBOL6 DT+SYMBOL7	
	C IFFF INC. INT. DATA ANUMBR /IH	3R /1H0,	1111, 1	112, 1113,	1.144,	145, 146	, 1H7,	1843 1842, 1847 DATA ANUMBR /1849, 1881, 1883, 1884, 1885, 1886, 1887, 1889, 184-001550 /	001540 LH-001550	DT+SYMBOL8 DT+SYMBOL9	
	DATA SEP / DATA DOLLA	SEP /1H3, 1H7, 1H7, 1HC, 1H)/ DQLLAR /1H5/	/, 1H?,	1116, 11	/(+				001570	DT+SYMB011	
U U									001590	DT+SYMBOI3 BD-BDAT207	
ں ں ں	* *	FILL	IN XVAL	FILL IN XVALUE CONNON BLOCK	OM BLOCA	*	*		001610	DT+XVALUE2 DT+XVALUE3 DT+XVALUE3	
ن	DATA (((XVALUE(I,J,K),I=1,8),K=1,2),J=1,9) DIMMY SI DIF FOR MOMINIAL PESSONSE TIMES	ALUE(I),	JoK), I=	1,98), K=	Ly2)yJ=	1,91 /			001640	DT+XVALUES	
	1 8*0.,				-	5			001660	DI+XVALUED DI+XVALUE7	
U	_	DESIGNATOR TYPES	SES						001670	DI + XVALUER	
		2.,	3.	5.000					001690	DI+XVALU10	
U	TARGET	VELOCITIES	I.E.S	2# B • 9					001700	DT+XVALU11	
		3.5	5.9	8.9	ć.	3*0.9			001720	DI+XVALU13	
٠	2 0.9 GHN-TA	0.9 0.9 1.9	16.0	2.,	2.,	3*8.,			001730	DT+XVALU14	
		12.,	20.0	30.,	40.	10.	16.9	0:0	067100	DI+XVALU15	
	2 0.9	0.0	2.,	3.,	4.9	5.9	÷	. B	001760	DT+XVALU17	
	PEFLEC 1 .05,	110111	. 20.	0.5	***				001770	DI+XVALU18	
	2 0.9		2.,	3.6	, u				001100	DT+XVALU20	
U	ANGLES	_							001800	DT+XVALU21	
	1 0.,	25.	30.,	60°	•06	120.,	2*0.,		001810	DT+XVALU22	
		DEFLECTION BIASES	7.5ES	•	•	2.1	2*H•9		001820	DT+XVALU23	
	1 -200.	-200., -100.,	0.0	100.	5002	3*0.			001840	DT + XVALU25	
	·	1.,	5.3	3.,	4.,	3*8.			001850	DT+XVALU26	
		TARGET HEADINGS	ي د	30	0.4	4			001860	DT+XVALU27	
	2 0.,			3.6	•	3,40			001870	DI + XVALU28	
٥	SEFKER	SEFKER SENSITIVITIES	VITIES						001890	DT+XVALU30	
ن د د د د	THE FOLLOW	ING CARE	CONTA	INS FALS	E SEEKE	R SENSI	TIVITY	FOLLOWING CARD CONTAINS FALSE SEERER SENSITIVITY VALUES TO	001900	DT+XVALU31	
) DEC	AVULD INCLUDING CLASSIFIED MURRERS IN THE PROGRAM LISTING. THE CORPECT VALUES SHOULD BE DESTORED WHEN DIRBURG IN 4 SEA	UDING CL	ASSIFI	ED MUMBE	L NI SAN	HE PROG	RAM LIS	TING.	001910	DT+XVALU32	
CSEC	ENVIRONMENT, ROMS DOME WITH THESE EATSE VALUES ARE EDD EXAMPLE	T. RUMS	DOME	DOME WITH THESE FALSE VALUES ARE EDD	5 17 J JS	F VALUE	A APF F	DP FXAMPLE	026100	01 + X V A L U 3 3	
SEC	PURPOSES DNLY.	NLY.	:						001940	DT + XVALU35	
	1 24.,	36.,	48.	60ء	72.,	340.			001950	DT+XVALU36	
U	6.0	1.,	6.7	•	4.3	3*8./			001960	DT+XVALU37	
	END								005569	BD-BDAT209	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 8 OF 82)

```
FN-FPRCNT3
FN-FPRCNT4
FN-FPRCNT5
FN-FPRCNT5
FN-FPRCNT5
FN-FPRCNT7
FN-FPRCNT9
FN-FPRCNT9
FN-FPRCNT9
                                                                                                                                                                            FN-FPRCN14
FN-FPRCN15
FN-FPRCN16
FN-FPRCN17
                                                                                                                                                                                                                         FN-FPRCN18
FN-FPRCN19
FN-FPRCN20
FN-FPRCN21
                                                                                                                                                                                                                                                                     FN-FPRCN23
FN-FPRCN23
FN-FPRCN25
FN-FPRCN25
FN-FPRCN27
FN-FPRCN27
FN-FPRCN29
FN-FPRCN29
FN-FPRCN31
                                                                                                                                                      FN-FPRCN12
FN-FPRCN13
                                   005580
005500
005600
005610
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005650
005570
005770
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005770
                                                                                                                                                                                                            IF (XIN.LT.O.) XRUT=10H UNDFF
IF (0.0.LE.XIN.AND.XIN.LT.10O.) ENCYDE (10,150,XRUT) XIN
IF (XIN.GE.10O.) XRUT=10H 100.0%
FPRCNT=XRUT
                                                                                                                 If (XIN-LT.0.0) XDUT=6NUNDEF)
If (0.0.LE.XIN.AND.XIN-LT.1.) ENCODE (6,120,XDUT) XIN
IF (1..LE.XIN.AND.XIN-LT.1.0.) ENCODE (7,130,XNUT) XIN
IF (10.LE.XIN.AND.XIN-LT.1.00.) ENCODE (7,140,XDUT) XIN
IF (XIN-GE.100.) XDUT=7H100.0Z)
FPRCHT=XQUT
GO IN 110
                                                                                IF (XIN.GE.100.05) STOP ' IN FPRCHT: EPPOP HUMBER 1 IF (.NOT.PAPEH) GO TO 100
                                                                                                                                                                                                                                                                                                            STATEMENTS
                                      FUNCTION FPECNT (XIN, PAPEN)
                                                                                                                                                                                                                                                                                                                                    120 FORMAT (140,F3,2,24%))
130 FORMAT (F4,2,24%))
140 FORMAT (F5,2,24%))
150 FORMAT (4X,F5,2,14%)
                                                                                                                                                                                                                                                                                                              ** * FORMAT
                                                               LIGICAL PAREN
                                                                                                                                                                                                                                                                             110 RETURN
                                                                                                                                                                                                                    100
                                                                                                                                                                                                                                                                   U
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LISTENG D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 9 OF 82)

FN-GAMMA 2 FN-GAMMA 3			
005900			096500
FUNCTION GAMMA (ALPHA, IRN) DIMENSION WK(6), R(1)	IN=1 CALL GGAMA (IRN,A! PHA,IH,WK,	GAMMA=R(1) RETHEN	END

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 10 OF 82)

```
CM+SYMBOL2
CM+SYMBOL3
FN-IOCHAR5
FN-IDCHAR6
FN-IOCHAR7
                                                                                              FN-10CHAR9
FN-10CHA11
FN-10CHA13
FN-10CHA13
FN-10CHA14
FN-10CHA15
FN-10CHA16
FN-10CHA16
FN-10CHA18
FN-10CHA21
FN-10CHA20
FN-10CHA21
FN-10CHA21
FN-10CHA23
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FN-10CHA23
FN-10CHA23
                                                                                     006040
006050
006050
006080
006080
006130
006130
006150
006160
006180
006180
006280
006280
                             005980
005990
000970
006010
006020
006030
                                                                                                                                                                                                                                                                                                            006290
                                          COMMON /SYMBOL/ BLANK, DECPNT, ALFBET(27), ANUMBR(11), SEP(5), DOLLAR.
                                                                                                                              D9 120 J=1,11
IF (A(I).HE.AHUMAR(J)) 60 T0 120
                                                                                                                                                                                                                             (A(I).NE.ALFRET(J)) GD TN 140
                                                                                                                                                                CONTINUE
DO 130 J=1,5
IF (A(I).NE.SFP(J)) GO TO 130
                                                                                                     IF (A(I).ME.DECPHI) 60 TO 110
                                                                                                                                                                                                                                                             IF (A(I).NE.DOLLAR) GN TO 150
IDCHAR=5
                                                                           IF (A(I).NE.BLANK) GO TO 100
IDCHAR=3
                          FUNCTION IDCHAR (A,N,I)
                                                    1 DOLLAR
DIMFNSION A(N)
                                                                                                                                                                                                                    140 J=1,27
                                                                                                              IDCHAR=2
                                                                                                                                               (DCHAR=0
                                                                                                                                                                                                                                                                                         IDCHAR=6
RETURN
                                                                                                                                                                                                                                                      CONT INUE
                                                                                                                       RETURN
                                                                                              RETUPIN
                                                                                                                                                          RETURN
                                                                                                      100
                                                                                                                               110
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 11 OF 82)

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| F N - N U M R I I 19
| F N - N U M R I I 20
| F N - N U M R I 2 2
| F N - N U M R I 2 5
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                                                                                           FN-NUMRICS
FN-NUMRIC3
CM+SYMBOL2
CM+SYMBOL3
FN-NUMRIC5
FN-NUMRIC5
                                                                                                                                                                                                                                                                                                                                                                                                                                                                           FN-NUMRII3
FN-NUMRI14
FN-NUMRI15
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             FN-NUMRI 32
FN-NUMRI 33
                                                                                                                                                                                                                                                                                                                                                                                   FN-NUMRI10
FN-NUMRI11
                                                                                                                                                                                                                                                                                       FN-NUMRIC7
                                                                                                                                                                                                                                                                                                                      FN-NUMRIC8
                                                                                                                                                                                                                                                                                                                                                      FN-NUMRIC9
                                                                                                                                                                                                                                                                                                                                                                                                                                                  FN-NUMRI12
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              FN-NUMRI16
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          FN-NUMRI17
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               160 FORMAT (80A1)
170 FORMAT (1H ,17H IN NUMRIC. LINE,13,30H HAD TOO MANY DECIMAL POINTO06660
15 : //(1X,8A10))
18 : //(1X,8A10)
190 FORMAT (80A1)
190 FORMAT (1H ,17H IN NUMRIC. LINE,13,49H EXCEEDS ALLOWARLE FIELD WIO06690
101 FOR NUMRIC DATA : //(1X,8A10))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    006700
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000970
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                               006420
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          006470
                                                                                                                                                              COMMON /SYMROL/ ALANK, DECPHT, ALFOFT(27), ANUMBR(11), SEP(5),
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          IF (IDCHE, ME. 2) GN TO 130
IF (DECFLE, EQ. 4.0) GN TO 120
WRITF (6.1770) ID, (BKII, IZ), II=1, MI), IZ=1, MZ)
STOP 'IN UUMRIC: ERPOR NUMBER I'
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              NUMRIC=.TRUE.
IF (KILE=10) RETURN
WRITE (6,190) IB, (B(II).IB),II=1,NI),IZ=1,NZ)
                                                                                                                                                                                                                                                                                                                             DECFLG=0.0
DECODE (80,160,8(1,1R) )(C(IC),IC=1,80)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      STATEMENTS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ENCODE (80,180,8(1,18) )(C(1),1=1,80)
                                                                                                     LUGICAL FUNCTION NUMRICIB, NI, NZ, IR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            IF (IDCHR.NE.3) RETURN
IF (DECFLG.NE.0.0) GO TO 150
C(KI)=DECPNT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  IDCHR=IDCHAR(C,80,KI)
IF (IDCHR,NE,0) GN TO 110
                                                                                                                                                                                                 DOLLAR
DIMENSION B(HI, HZ), C(80)
                                                                                                                                                                                                                                                                                                                                                                                                                                                     IF (KI.GT.80) 60 TO 140
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         * * * F D P M A T
                                                                                                                                                                                                                                                                                             NUMP.IC = . FALSE.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            DECF16=1.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         TO 100
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    TO 100
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            KI=KI+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    =K I+1
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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00000000011111111112222222233333333334444444445555555556666666666	77777777 73456789	8888888889 01234567890	COLUMN NUMBERS (READ VERTICALLY)
FILMETICAL UPANST (T)	006730	FN-URAN312	
IF (1) 110, 100, 110	006740		
100 1=1111111	006750	FN-URAN314	
10 10	006760	FN-URAN315	
\(\sigma \pi \)	006770	FN-URAN316	
J=J-(J/67108864)*67108864	006780	FN-URAN317	
	064900	FN-URAN318	
J=J-(J/67108864)*67108864	008900	FN-URAN319	
# * * * * * * * * * * * * * * * * * * *	006810	FN-URAN310	
J=J-(J/67108864)*67108864	006820	FN-URAN311	
A] = J	006830	FN-URAN312	
7 1 1	006840	FN-URAN313	
UBAN31=A1/67108864.	006850	FN-URAN314	
RETURN	006860	FN-URAN315	
END	006870	FN-URAN316	
0000000011111111111222222223333333344444444555555556666666666	77777777 123456789	8888888889 01234567890	COLUMN NUMBERS (READ VERTICALLY)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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000000000111111111122222222223333333333	1890123456789	8888888889 COLUMN NUMBI 01234567890 (READ VERTI	ERS CALLY)
SUBPOUTINE ABRTTL (IARRT)	006890	SR-ABRITL2	
C COMMENT AND OPT (20.4). NCARI M	000110	CM+ABURT 2	
COMMON FEAST HARDEN LOSS TOWN TO THE TOWN THE TRADER, INTELS,	_	CM+FLAG 2	
1 ENDFL6	_	CM+FLAG 3	
LOGICAL ENDFLG, ENDREP	026000	CM+FLAG 4	
COMMON /RPLCIN/ KRIP, NRFP, KRF, NRF, NVFHKL	0000770	CM+KPLCINZ SR-ABRITL7	
101	006920	SR-ABRITL8	
TATAL TATAL MANABAN OU TO 100	096900	SR-ABRTTL9	
NARDTER TENDENCY (TENDENCY) + 11 AND TENDENCY (TENDENCY) + 1	026900	SR-ABRIT10	
FILE TO TO TO TO TO TO TO TO TO TO TO TO TO	086900	SP-ABRTT11	
	066900	SR-ABRTT12	
100 00 110 11=1PE.NPF	00200	SR-ABRTT13	
AVRIDATE TARTE I LA MARIDATE LA DEL MARIDATE LA DEL MARIDATE LA MARIDATE LA MARIDATE LA MARIDATE LA DESTRUCTION DE LA MARIDATE	001010	SR-ABRTT14	
THE THE PERSON OF THE PERSON O	001020	SR-ABRIT15	
10000	001030	SR-ABRTT16	
120 FUNDED TRIFE	00 20 40	SR-ABRTT17	
	001050	SR-ABRTT18	
140111114	090200	SR-ABRIT19	
T-IO-IO	007070	SR-ABRIT20	
END	00 2 0 8 0	SR-ABRTT21	
0000000001111111111222222222233333334444444444	56677777777777777777777777777777777777	888888888 COLUMN NUMB 01234567890 (READ VERTI	ERS CALLY)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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0000	000000000111111111122222222333333344444444455555556666666666	7777781 567890	388888889 1234567890	COLUMN NUMBERS (READ VERTICALLY)
·	SUBROUTINE ADDIBP 007	7100	007100 SR-ADDIBR2	
، ر	COMMON /TIME/ DUPLOS, TIMHOW, TOF, TRR, TIMPA, TIMPAL OOI	007110	SR-ADDTBR3 CM+TIME 2	
ن	11 MP A = TT MP A + TR P		SR-ADDIBR5	
U		00/11/0	SR-ADDTBR6 SR-ADDTBR7	
	KE TUEN 00 7		SR-ADD TBRB	
ر	007	0071700	SR-ADDIBR9	
	E10) 007	007180	SR-ADDIB10	
0000 1234	0000000001111111112222222222333333334444444555555555666666666777777778888888888	777778 5678901	388888889 1234567890	COLUMN NUMBERS (Read Vertically)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 15 OF 82)

123	0000000001111111111222222222233333334444444444	8888888889 C. 01234567890 (1	OLUMN NUMBERS Read Vertically)
ر	SUBROUTINE ADDTOF 007200 S	007200 SR-ADDTDF2 007210 SR-ADDTOF3	
, (COMMON /TIME/ DURLOS, TIMNOW, TOF, TBR, TIMRA, TIMRAL 001020 C	CM+TIME 2 SR-ADDIOF5	
ى ر	TIMP. A= TIM10W+TOF 007240 007250 007250	SR-ADDTOF6 SR-ADDTOF7	
, (SR-ADD TOF8	
د		SR-ADDITO10	
123	000000001111111112222222223333333344444444455555556666666666	888888889 C	OLUMN NUMBERS READ VERTICALLY)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 16 OF 82)

888889 COLUMN NUMBERS	890 (READ VERTICALLY)
0n00000000111111111222222222233333333344444444555555556666666667777777888888888	123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890 (READ VERTICALLY)

SR-ARTCHK2	SK-AKICHK3 CM+KTEST 2	CM+MISC 2	CM+RANDOM2	CM+RANDOM3	CM+RANDOM4	CM+RPLCIN2	SR-ARTCHK8	SR-ARTCHK9	SR-ARICH10	SR-ARTCH11	SR-ARTCH12	SR-ARTCH13	SR-ARTCH14	SR-ARTCH15	SR-ARICH16	SR-ARTCH17	SR-ARTCH18	SR-ARTCH19	
002300	ST(20,6) 000440	COMMON /MISC/ DOARPK, PDSTKL, RELIF	13, IR2, IR3, IR4, IR5, IR6, IR7, IR8, IR9, IR10,000640	19 1814, IR15, IR16, IR17, IR18, IR19, IR20, IR21000650	: 9 IR229 IR239 IR249 IR259 IR259 IR279 IR28		007360	007370			GH TO 100 007400	01410			044200	04420	095400	001410	
SUBBRUTINE APTOUR	COMMON /KTEST/ KTFST(20,6)	COMMON INISCI DOVE	COMMON /RANDOM/ IF	I IRIL, IRIZ, IRIZ	2 , IR22, IR23, IR	CHMMMM /RPLCTN/ KP		PHI=URAN31(IRI)		KTEST(1, KRF)=KTEST(1, KRF)+1	IF (RNI.GT.DNARPK) GN TO 100		IABRT=1	CALL ABRITL (IAPFT		OO RETURN		END	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 17 OF 82)

000000000111111111111122222233333333334444444444	6777777777 90123456789	01234567890	COLUMN NUMBERS (READ VERTICALLY)
SUBPRINTINE BLOCHK	007490	SR-BLOCHK2	
ပ	002200	SR-BLOCHK3	
COMMON /BAIL/ BLORMG, IBAIL	000110	CM+BAIL 2	
COMMON /KTEST/ KTEST(20,6)	0004400	CM+KTEST 2	
COMMON /RANGE/ DIEMG, MXDRHG, VISLIM, ENGNOW	000080	CM+RANGE 2	
RFAL MXDRNG	069000	CM+RANGE 3	
COMMON JEPLCIN/ KREP, NREP, KRF, NRF, NVEHKL	000110	CM+RPLCTN2	
COMMON /TARGET/ TVEL, NVEHCL, DISRVH, ITGITF, IMUTS, ITGIFS	00100	CM+TARGET2	
COUNDN /TIME/ DUELOS, TIMNOW, TOF, T9R, TIMEA, TIMEA1	001050	CM+TIME 2	
U	007570	SR-BLOCH10	
IF (IBAIL.EQ.1) KTEST(7,KRF)=KTEST(7,KRF)+1	007580	SR-810CH11	
IF (IBAIL.EQ.2) KTEST(10, KRF)=KTEST(10, KPF)+1	007590	SR-810CH12	
IF ((DTENG-TVEL*TIMHOW).GT.BLORNG) GO TO 100	009200	SP-8L0CH13	
v	007610	SR-BL 0CH14	
IABRT=7	007620	SR-BLOCH15	
IF (IBAIL.EO.2) IABRT=10	069200	SP-BLOCH16	
CALL ABRITL (IABRI)	00 1640	SR-8L0CH17	
U	001650	SR-810CH18	
100 RETUPH	099200	SR-BLOCH19	
U	001670	SR-BLOCH20	
END	007680	SR-BLOCH21	
00000000011111111112222222333333334444444444	6777777777 90123456789	888888889 01234567890	COLUMN NUMBERS (READ VERTICALLY)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 18 OF 82)

COLUMN NUMBERS (READ VERTICALLY)		COLUMN NUMBERS (READ VERTICALLY)
18888888889 1234567890	SR-CCPLOT2 SR-CCPLOT3 CR+RUNDT5 SR-CCPLOT5 SR-CCPLOT6 SR-CCPLOT7 SR-CCPLOT0 S	888888889 01234567890
,7777777778 001234567890	007700 007710 0007730 007730 007750 007760 007770 007770 007780 007780 007780 007880 007820 007820 007820	67777777777 90123456789
;5555556666666666666666666666666666666	; TH ICCPF6= ,11,23b	55555556666666666666666666666666666666
0000000011111111122222223333334444444444	SUBROUTINE CCPLOT C COMMON /PUNDAT/ DAT, TIM, NCASE, ICCPFG, IPPFG DIHENSION CHILO) C ENCODE (100,100,CM(1)) NCASE, ICCPFG CALL COMMNT (CM,10,.FALSE,).FALSE,) C RETURN C RETURN C * * * F OR M A T S T A T F M E M T S * * * C 100 FORMAT (1M , 20M IN CCPLOT FOR CASE , 12,14H WITH ICCPFG * 11,23H . I NO PLOT PRODUCED .) E ND	00000000011111111112222222222233333334444444444

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 19 OF 82)

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SR-COMMNTS
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SR-COMMN42
SR-COMMN43
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SR-COMMN46
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SR-COMMN48
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008270
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180 FORMAT (40H IN COUNT. TOO MANY $$ COMMENTS (>20):,/,20(1X,12,1X,008320
113A10,/),/,54H THE FOLLOWING COUNENT CAUSED OVERFLOW OF CHENT ARRAGO8330
2Y:,/,1X,12,1X,13A10)
008340
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               150 FORMAT (12H ** USER ** ,80A1)
160 FORMAT (1H1,5(8H$$$ $$$ ),4X,30HCOHHENTS FOR THIS SFT OF CASES,4X,008290
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         008300
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                                                                                                                            COMMON /COMENT/ CMENT(13,20), COMBUF(13), ICMNT, NTRC
                                                                                                                                                                                                                                                                                                                                                                                                                         ENCODE (120,150,CMFNT(1,ICMNT) )(A(I),I=3,80)
60 TO 130
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           ICMNT=ICMNT+1
EHCUDF (120,170,CMENT(1,ICMNT) )(A(I),I=1,10)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            IF (ICMNT.LE.20) GD TO 140
WRITE (6,180) (K, (CHEHT(J.K), J=1,13),K=1,21)
STOP ' IH COHMHT: TOO MANY $$ COMMENTS '
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            *
                                                                            SUBRUITINE COMMIT (A, NI, USERC, SLCOM3)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       STATEMENTS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  IF (NTRC.EQ.0) WRITF (6,160)
WRITF (6,150) (A(I), I=4,80)
NTRC=NTRC+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                IF (NTRC.EQ.0) URITE (6,160)
WRITE (6,170) (A(I), I=1,10)
NTRC=NTRC+1
                                                                                                                                                                                                                                                               IF (.HOT.USERC) GD TD 110
IF (A(2).NE.1H$) GD TD 140
                                                                                                                                                                                                                                                                                                                                            IF (A(3),EQ,1H$) 60 TO 100
                                                                                                                                                                                DIMENSION A(NI)
LUGICAL USERC, SICONS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    IF (SLCON3) GD TO 120
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  * * * FORMAT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         15(811$$$ $$$ 1,/)
                                                                                                                                                                                                                                                                                                                                                                                      ICMNT=ICMNT+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  GN TN 140
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 20 OF 82)

D-22

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COLUMN NUMBERS (READ VERTICALLY)
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SR-CREAD28
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SR-CREAD12
SR-CREAD13
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SR-CREAD19
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SR-CREAD31
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CM+WEATHR2
CM+WEATHR3
CM+WEATHR4
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SR-CREAD22
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                                                                                                                                                                                                        CM+RSPTIM2
CM+RSPTIM3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SR-CREAD26
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                                                                                                                                                        CM+RANDOC2
CM+RNGLOS2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SR-CREAD15
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CM+RNGLOS3
                                                                                                                                                                                                                                        CM+RSPTIM4
                                                                                                CM+DODF
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                                                                                                            CM+HIT
CM+HIT
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                                                                                                                                                      COMPON / RAHDEC/ TCRIT, HPLESP, PHGPLS(10), PRBLDS(10) 000620 COMPON / RNGCUS/ HRP, HPP, HRHGCL, CPHGD(11,2), SEGLOS(11,11), 000740 COMPON / RNGCLB(11), VELTBL(2,2) CHAPTH(2,1), DUM1, BCSPTH(2,2), XMITIM(2,000790 COMPON FRANC,2), TSIGMA(2,2), DTTMA(10,2), HDT, TRARRY(3,2), 000800 2 PRSPTH, FBAR, PRSDT, PRSUT, ALFHA(2,2), RETA(2,2), DETTIM, 000800 3 IDSGTP, RUMC, PRENCC, PRECCES, PROMON COMPON FROM / WHATHR/ PRCLCS, PRCGCES, PROMON COMPON COMPON FROM (11,2), HGATHR/ PRCLCS, PRCGCES, PROMON COMPON COMPON COMPON (11,2), CLUUD(6), HCC, HVL, PASQL(6), WNDSPD(3,3), HUMID(2), 001000 2 WSUM(2), WGFSUM(2), ICC, IVL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       098800
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000260
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                                                                                                        LOGICAL DOKILD
COMMON /HIT/ INDEX(6,5,2), PETBL(60,10,7), DLTI(6), PKTBL(10,2),
NRHGTT, RNGTTF(20), TTF(3,20,2), NRHGPS, RHGPST(10), PSTTBL(10)
                                                                                                                                                                                                                                                                                                                                      DIMENSION WDATA(193), ACQDAT(161), PSFDAT(49), DFSDAT(31)
DIMENSION RODATA(22), PEDATA(4260), PSTDAT(41), AINVDA(167)
                                                                                 COMMON JOODE/ DEPOKE(10,3), NDESP, NDOKIL, POKILD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               GO TO (100,150,200,230,260,280,340,370), ITYPE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             DU 110 I=1,193
WDATA(I)=0.0
READ (5,420) NCC,NVL
READ (5,430) PRCLCG, (PRCFLS(I),I=1,2)
DU 120 J=1,2
READ (5,430) (PPGCFL(I,J),I=1,11)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                     EQUIVALENCE (WDATA(1), PPCLCG)
EQUIVALENCE (RSPDAT(1), MPP)
EQUIVALENCE (RSPDAT(1), DEDRH(1))
EQUIVALENCE (PSDAT(1), DEDRH(1))
EQUIVALENCE (RDDATA(1), TCRIT)
EQUIVALENCE (PEDATA(1), MRMSPS)
EQUIVALENCE (PSTATA(1), MRMSPS)
EQUIVALENCE (ATHVDA(1), MRMSPS)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       READ (5,430) (WNDSPD(1,J),I=1,3)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       READ (5,430) (VIS(1),1=1,NVL)
READ (5,430) (CLOUD(1),1=1,HCC)
READ (5,430) (PASQL(1),1=1,6)
DG 140 J=1,3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        READ (5,430) (W(I, J,K),I=1,MC)
CONTINUE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DIMFHSION A(80), B(8,10)
                                                        SUBROUTINE CREAD (IT2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DO 130 K=1,2
DO 130 J=1,11
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 21 OF 82)

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000000000111111111222222233333333444444455555566666666666777777777888888888 COLUMN NUMBERS
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890 (READ VERTICALLY)
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SR-CREAD40
SR-CREAD41
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009110
009120
009130
                                                                                                                                                                                                                                                                                                                        READ (5,460) (BATRIN(1),1=1,3), (XNVADF (1),1=1,2)
READ (5,460) ((BCSPTH(1,1),1=1,2),1=1,2),1(XHTIM(1,1),1=1,2),1=1,008950
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                                                                                                                                                                                                                                                                                                                                                            READ (5,460) ((TMEAN(1,J)), I=1,2), J=1,2), ((TSIGMA(1,J), I=1,2), J=1,
                                                                                                                                                                                                                                                                                                                                                                                     READ (5,460) ((TRARRY(1,1),1=1,3), J=1,2)
GO TO 410
                                                                                                                                                                                                                                                                                                                                                                                                                                                READ (5,450) NDFSP
DO 250 J=1,3
READ (5,460) (DFDOKL(1,J),I=1,NDFSP)
                                                                                                                                                                          READ (5,460) (RNGCLB(I), I=1, NP.NGCL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         READ (5,460) (PHOPLS(I), I=1, NPLOSP)
READ (5,460) (PRBLNS(I), I=1, MPLOSP)
GO TO 410
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             READ (5,490) (A(I),I=1,80)
CALL SEPREC (A,RO,B,8,10)
IF (B(1,1),HE.8HUSETAPE4) GN TN 300
                                                                                                                                     DO 180 J=1,NPNGCB
READ (5,460) (SEGLOS(1,J),I=1,NPP)
CONTINUE
                                                                                                                                                                                                                                                                                     DO 220 J=1,2
READ (5,460) (DETTMA(1,J), I=1,NDT)
CONTINUE
                                                                                                            READ (5,460) (CRNGD(I,J),I=1,HRP)
                                                                                                                                                                                     DO 190 J=1,2
READ (5,460) (VELTRL(I,J),I=1,2)
CONTINUE
                                                150 DO 160 I=1,161
160 ACQDAT(I)=0.0
READ (5,440) HRP,HPP,HRHGCL
NRHGCB=NRHGCL+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                READ (5,450) NPLUSP
READ (5,460) TCRIT
                                                                                                                                                                                                                                                DN 210 I=1,49
RSPDAT(I)=0.0
READ (5,450) NDT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          DO 290 I=1,4260
PFDATA(I)=0.0
                                                                                                                                                                                                                                                                                                                                                                                                                          DA 240 I=1,31
                                                                                                                                                                                                                                                                                                                                                                                                                                      DFSDAT(I)=0.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          DO 270 I=1,22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      RUDATA(I)=0.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    CONTINUE
GO TO 410
                                                                                                                                                                                                                            60 TO 410
                                                                                                                          CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    IUNIT=5
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 22 OF 82)

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SP-CREALOS
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                                                                                                                                                                                                                                                                                                                                                                                 READ (5,460) PHGTTF(J),((TTF(1,J,K),K=1,2),1=1,3)
CHNTINUE
         GO TO 310
ENCODE (20,490,8(1,1) )(A(1),1=1,20)
DECODE (20,470,B(1,1) )(INDEX(1,1,K),K=1,2)
CONTINUE
                                                                                                                                                                                                            340 DN 350 I=1,41
350 PSTDAT(I)=0.0
READ (5,450) HRHGPS
READ (5,460) (RHGPST(I),I=1,HRHGPS)
00 360 J=1,3
READ (5,460) (PSTTBL(I,J),I=1,HPHGPS)
360 CNHTHUE
60 TO 410
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   STATEMENTS
                                                                              IF (I. EQ.1. AND. IUNIT. EQ. 5) ISTART=2
DD 320 J=ISTART. 5
READ (IUNIT, 470) (INDEX(I, J, K), K=1,2)
CONTINUE
                                                                                                                                DD 330 I=1,60
DD 330 J=1,10
READ (IUNIT,480) (PETBL(I,J,K),K=1,7)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                        DD 400 J=1,2
READ (5,460) (PKTBL(1, J), I=1,7)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                READ (5,460) (DLTT(1), I=1,6)
                                                                                                                                                                                                                                                                                                                                     ) DU 380 I=1,167
AINVDA(I)=0,0
READ (5,450) NRHGTT
DU 390 J=1,NRNGTT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             420 FURNAT (215)
430 FURNAT (8F10.4)
440 FURNAT (315)
450 FURNAT (15)
470 FURNAT (2110)
470 FURNAT (7F10.5)
490 FURNAT (7710.5)
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                                                          DO 320 I=1,6
ISTAPT=1
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                                                                                                                                                                                           60 TO 410
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 23 OF 82)

SR-DETCTN3 SR-DETCTN3 CM+FLAG 2 CM+FLAG 3 CM+FLAG 4 CM+KTEST 2 CM+KTEST 2 CM+KRANDOM3 CM+RSPTIMS CM+RSPTIM3 CM+RSPTIM4 CM+RSPTIM4 CM+RSPTIM6 CM+TIME 2 SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO SR-DETCTIO CM+RANDOM4 000800 000810 000820 001020 009860 009860 009980 009990 009910 009910 009910 009770 009780 000300 009950 CALL SMPLCD (DETTMA, 10, 2, 2, 10, 1P8, DETTIM, ICLASS) KTEST(4,KRF)=KTEST(4,KRF)+1
IF (DETTIM-LT.DURLOS) GD TO 100 IF (IRMDAC.Eq.1) GO TO 100 IABRT=4 CALL ABRTTL (IARRT) SUBROUTINE DETCTN 100 U

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 24 OF 82)

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COLUMN NUMBERS (READ VERTICALLY)
SR-DFAUL T2
SR-DFAUL T3
SR-DFAUL T4
SR-DFAUL T7
SR-DFAUL T9
SR-DFAUL T9
SR-DFAUL 11
SR-DFAUL 12
SR-DFAUL 12
SR-DFAUL 14
SR-DFAUL 15
SR-DFAUL 15
SR-DFAUL 16
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SR-DFAUL 17
SR-DFAUL 17
SR-DFAUL 27
SR-DFAUL 37
SR-DFAUL 47
SR-DFAUL 57
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COMMON / PUNDAT/ DAT, TIM, HCASE, ICCFFG, IPPFG

COMMON / PUNDAT/ DAT, TIM, HCASE, ICCFFG, IPPFG

LILD=1.

D(112)=1.

D(112)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    010430
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DIDIGT=1.
DSMK(1)=484.
DSMK(2)=846.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                D(60)=60.
D(61)=.075
D(62)=.975
DPRT=0.0
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 25 OF 82)

SR-DFAUL56 SR-DFAUL57 SF-DFAUL58 010530 010540 010550 RE TURN EMD

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 26 OF 82)

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CH+RANGE 2
CH+RANGE 3
CH+RANGE 3
CH+TARGET2
CH+TARGET2
CH+WEATHR2
CH+WEATHR3
CH+WEATHR3
CH+WEATHR3
SP-DFCHK12
SR-DFCHK13
SR-DFCHK13
SR-DFCHK14
SR-DFCHK16
SR-DFCHK16
SR-DFCHK20
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SR-DFCHK 3
CM+DODF 2
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CM+KTEST 2
CM+RTEST 2
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CM+RANDOM4
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00 02 50
00 02 60
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DD 100 I=1,NDFSP
IF (DFDDKL(I,1).LE.RHGMMW.AND.RHGNDW.LT.DFDDKL(I+1,1)) GD TD 110
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          FPAC=(RHGNOW-DFDAKL(I,1))/(DFDAKL(I+1,1)-DFDAKL(I,1))
PDGSUP-DFDOKL(I,2)+FRAC*(DFDOKL(I+1,2)-DFDOKL(I,2))
PDGXIL=DFDOKL(I,3)+FRAC*(DFDOKL(I+1,3)-DFDOKL(I,3))
                                                                                                                                                                COMMON /DODF/ DEPOKE(10,3), NDFSP, NDOKIL, DOKILD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        RN15=URAN31(IR15)
IF (RN15,GT, (PDGSUP+PDGKIL)) GG TG 130
IF (RN15,GT, PDGKIL) GG TG 120
NDGKILE-NDGKIL+1
DOKKLD=.TRUE.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  STOP * IN DECHK: FRROR NUMBER 1 *
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   KTEST(14,KRF) * KTEST(14,KRF)+1
IF (DOKILD) GO TO 120
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             IABRT=14
CALL ABRTTL (IABRT)
                                                                                                                  SUBROUTINE DECHK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    130 RETURN
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 27 OF 82)

0000	000000000111111111222222223333334444444445555555666666667777777777	8888889 COLUMN NUMBERS 4567890 (READ VERTICALLY)
ر	SUBROUTINE DUST 010950 SR-I	SR-DUST 2
,	010960	SR-DUST 3
		CM+MISC 2
	* IR7* IR8* IR9* IR10,000640 (IR18* IR19* IP2)	CM+RANDOM2
	099000	CM+RANDOM4
ن	_	CM+RPLCTN2
,		SR-DUST 8
U	011020	0UST 9
,		SR-DUST 10
	011040	00ST 11
U	011050	SR-DUST 12
,		OUST 13
	7TT1 (1AB5T) 011070	SR-DUST 14
U	011080)UST 15
101	•	SR-DUST 16
	011100	SR-DUST 17
,	011110 SR-C	SR-0UST 18
	011120	SR-DUST 19
1234	0000000001111111112222222333333344444445555555666666666667777777788888889 COLUMN NUMBERS 123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890 (READ VERTICALLY)	1888889 COLUMN NUMBERS 1567890 (READ VERTICALLY)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 28 OF 82)

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CM+RPLCTNZ
CM+RSPTIMZ
CM+RSPTIMS
CM+RSPTIM9
CM+RSPTIM9
CM+RSPTIM5
CM+RSPTIM5
CM+RSPTIM5
CM+RMNDAT2
CM+SMCED3
CM+SMCED3
CM+TARGETZ
CM+WEATHRZ
CM+WEATHRZ
CM+WEATHRZ
CM+WEATHRZ
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CM+RANGE 3
CM+RECNAM2
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CM+DVER 2
CM+PEDESC2
CM+RANDOC2
CM+RANGE 2
CM+RANGE 3
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CM+RNGLOS3
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CM+LD6FL63
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SP-ECHO
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                   COMMON /BAIL/ BLORMG, IBAIL
COMMON /DODF/ DEDOKL(10,3), NDFSP, NDOKIL, DOKILD
LOGICAL DOKILD
COMMON /TLAG/ ENDREP, IDN, IPREPL, IDIGTL, IPPTY, IRNDOC, IT3FLG,
COMMON /TLAG/ ENDREP
LOGICAL ENDELG, FNDREP
COMMON /HIT/ INDEX(6,5,2), FFIBL(60,10,7), DLIT(6), PKTBL(10,2),
COMMON /HIT/ INDEX(6,5,2), TIF(3,20,2), NRNGFS, PNGFST(10), PSTTBL(10,2),
2 3)
                                                                                                                                                                                                                                                                                                                                                         COMMON TARGET/ TVEL, MVEHCL, DISBVH, ITGITP, IMUIS, ITGIPS COMMON /IIME/ DUFLOS, TIMHOM, TOF, TBR, TIMPA, TIMRAL COMMON /MEATHR/ PRCLCG, PRCFLS(2), PRGCFL(11,2), W(6,11,2), 1 VIS(11), CLOUD(6), NCC, NVL, PASQL(6), WNDSPD(3,3), HUMID(2), 2 WSUM(2), WCFSUM(2), LCC, IVL
                                                                                                                        COMMON /LOGFLG/ FIRSTL, SEGNML, SPCL(70), SHRTEC, FTSILL LOGICAL FIRSTL, SEGNML, SPCL, SHRTEC, FTSILL COMMON /MISC/ DOAFPK, POSTKL, PELIF COMMON /OVER/ INVER[70]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 WEITE (IUNIT, 210) NCC, NVL
WRITE (IUNIT, 220) (WCF SUM(I), I=1,2), (WSUM(I), I=1,2)
WRITE (IUNIT, 220) (PASOL (I), I=1,6)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (IUNIT, 220) TOF, TBR
(IUNIT, 230) TVEL, HVEHCL, DISBUH, ITGTTP
(IUNIT, 220) PPCLCG, (PRCFLS(I), I=1, 2)
(IUNIT, 240) ((PRGCFL(I, 1), I=1,11), J=1,2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                       DOAPPK,PSMKKL,PNSTKL,PELIF
NSHK2,NSMK5
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           WELLE (LUMIT, 220) (WII, J, K), I-1, MCC) CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                   NCASE
NREP, NPF
                                                                                                                                                                                                                                                                                                                                                                                                                                                                               HXDPHG
    SUBROUTINE ECHO (IUNIT)
                                                                                                                                                                                                                                                                                                                                                                                                                                   WRITE (IUNIT, 200) NG
WRITE (IUNIT, 210) NF
WRITE (IUNIT, 220) NF
WRITE (IUNIT, 220) NF
WRITE (IUNIT, 220) NF
WRITE (IUNIT, 230) NF
WRITE (IUNIT, 230) NF
WRITE (IUNIT, 220) NF
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DO 100 K=1,2
DO 100 J=1,MVL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        po 110 J=1,3
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COPE PROGRAM

9F

LISTING D-1 FORTRAN LISTING

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COLUMN NUMBERS (READ VERTICALLY)
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DO 160 J=1,20

UNITE (IUNIT,220) ENGTT((J), ((TTF(I,J,K),K=1,2),I=1,3)

WRITE (IUNIT,220) (DLTT((I),I=1,6))

WRITE (IUNIT,220) (DTTT((I),I=1,6))

WRITE (IUNIT,220) (PKTDL(I,J,I=1,10))

WRITE (IUNIT,220) (KFTTBL(I,J,I=1,10))

WRITE (IUNIT,220) (KFTTBL(I,J,I=1,10))

WRITE (IUNIT,220) (KFTTBL(I,J,I=1,10),J=1,3)

WRITE (IUNIT,220) (KFTTBL(I,J,I=1,10),J=1,2)

WRITE (IUNIT,220) (KFTTR(I,I=1,10),J=1,2),(KMTTH(I,J),I=1,2)

WRITE (IUNIT,220) (KFTTR(I,I,I=1,10),J=1,2),(KMTTH(I,J),I=1,2),(IIB50)

WRITE (IUNIT,220) (KFTTR(I,I,I=1,10),J=1,2),(KMTTH(I,I,I),I=1,2),(IIB60)

WRITE (IUNIT,220) (KTTTR(I,I,I),I=1,2),J=1,2),(KMTTH(I,I,I),I=1,2),(IIB60)

WRITE (IUNIT,220) (KTTTR(I,I,I,I,I=1,2),IIB60)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              011740
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WRITE (IUNIT,220) ((ALPHA(I,J),I=1,2),J=1,2),((BETA(I,J),I=1,2),
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      1 J=1,2)
WRITE (IUNIT,210) HDT
WRITE (IUNIT,210) HDT
WRITE (IUNIT,220) ((DETTHA(I,J),I=1,10),J=1,2)
WRITE (IUNIT,220) (TERRY(I,J),I=1,3),J=1,2)
WRITE (IUNIT,220) (TRSPTH,TRBAB,PRSOT,PRSVT,PCRHSG,PRODW,RUMC
WRITE (IUNIT,210) IDSGTP
IF (IRNDC,Eq.0) GD 170
WRITE (IUNIT,220) TCPIT
WRITE (IUNIT,220) (RNGPLS(I),I=1,10)
WRITE (IUNIT,280) (RNGPLS(I),I=1,10)
                                                                                                                                                                                                                                                                                                                          IDN, IPREPL, IDIGTL, IPRTY, IRNDOC, IT3FLG
BLORNG
                                                                                                                                                                                                                                                                                                                                               WELLE (UNIT, 210) IDH, IPPE PL, IDIGTL, IPRTV, IRHDOC, IT3F WRITE (IUNIT, 220) BLORNG WRITE (IUNIT, 220) BLORNG WRITE (IUNIT, 250) (IOPEDOKL(I,J), I=1,10), J=1,3) WRITE (IUNIT, 250) ANGLET, GTRNG, REFL, DEFF, TGTHP, SKSEN IF (IUNER (26), Ne, 2) WRITE (IUNIT, 180) PECODE IF (IUNIT, 190) BCODE IF (SRREG), Eq. 2) WRITE (IUNIT, 190) DC II (SRREG) GG TO 150
WEITE (IUHIT, 220) (WHOSPD(1, J), 1=1,3)

WITE (IUNIT, 220) (HUMID(I), I=1,2)

WRITE (IUNIT, 240) (CRIDD(I, J), I=1,1), J=1,2)

WRITE (IUNIT, 240) (CRIDD(I, J), I=1,1), J=1,2)

WRITE (IUNIT, 240) (SEGLOS(I, J), I=1,11), J=1,2)

WRITE (IUNIT, 240) (ROGCLB(I, J), I=1,11)

WRITE (IUNIT, 240) (VELTRU(I, J), I=1,2)

OR IZO J=1,2

WRITE (IUNIT, 220) (VELTRU(I, J), I=1,2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             DO 140 I=1,60
WRITE (IUNIT,270) I,((PETBL(1,J,K),K=1,7),J=1,10)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   WRITE (IUNIT, 260) I, ((INDEX(I, J, K), K=1,2), J=1,5)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        STATEMENTS ***
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 31 OF 82)

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                                                                                                       COMMON /ICODE/ ICODE (COMMON /ICODE/ ICODE (COMMON /ICODE/ ICODE (COMMON /INDEXI/ INXII(2001) (COMMON /INDEXI/ INXII(2001) (COMMON /RUNDAT/ DAT, TIM, HCASE, ICCPFG, IPPFG (COMMON /SYMBOL/ BLANK, DECPMI, ALFBET(27), ANUMBP(11), SEP(5), DOLLAR.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           IF (IT(1),LT.6.0F.IT(1),GT.8) GN TO 160
IT (ITRY-EQ.0.0P.,CO.LT.11(2),AND.IT(2),LE.30)) GN TO 150
WPITE (6,230) (B(12,JK),JK=1,H2),IT(2),GHAR(3,IMATCH1)
STOP " IN FINDIT: ERROR HUMBER 2"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           WRITE (6,240) IB, ((B(11,12),11=1,41),12=1,42)
STOP * IN FINDIT: ERROR HUNGER 1 *
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DO 120 J=1,8
IF (8(J,IB).HE.CHAE(J+2,I)) 60 TO 130
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        IT1=IT(1)
IF (ChAP(2)IMATCH), FQ.0.0) GO TO 210
ICHNL=CHAP(2)IMATCH)
CHPRL=300
                                                                    SUBRIUTINE FINDIT (8,411,112,11,43)
                                                                                                                                                                                                                                                                                        DIMENSION B(HL,N2), IT(N3)
DIMENSION CHARA(10,30), IRAY(6)
                                                                                                                                                                                                                                                                                                                                                           EQUIVALENCE (ICODE, CODE)
                                                                                                                                                                                                                                                                                                                                                                                                                                            IRAY(1)=0
IRAY(5)=LOCF(NOREC)
CALL SYSTEMC (104,IRAY)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       IF (ITRY.EQ.1) RETURN
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    IMATCH1 = IMATCH
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                                                                                                                                                                                                                                                                                                                                                                                                     LIGICAL NUMRIC
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CONTINUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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IF (CHAR(1, IMATCH), EQ. CHAR(1, IMATCH+1)) CODF=CHAR(3, IMATCH+1)
CALL READMS (11, CHARA, ICHREL, ICMDF)
LHXMR=N3
DO 200 1=2, IMXNR
IF (8(1, 1), EQ. BLANK) GU TU 200
DO 180 K=1, ICHN
IF (11, NE, IFIX(CHARA(2, K))) GU TU 180
DU 170 J=1, 8
IF (8(1, 1), NE, CHARA(J+2, K)) GO TU 180
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                    IF (NUMRIC(8,NI,NZ,IB)) 60 TO 190
WRITE (6,240) IB,((0(11,IZ),II=1,NI),IZ=1,NZ)
STOP * IN FINDIT: ERROR HUMBER, 3 *
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    220 WRITE (6,240) IB, ((B(I1,I2),I1=1,H1),I2=1,N2)
STOP ' IN FINDIT: EREOR NUMBER 4 '
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   IF (B(1,1B),EQ,BLANK) PETUPN
IF (,NOT.NUMRIC(B,N1,N2,IB)) GO TO 220
IT(IB)=0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           *** # 10 8 14 4 7
                                                                                                                                                                                                                                                                                                   IT(I)=CHARA(I,K)
GO TO 200
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200 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                 CONTINUE
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IB=2
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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	013160	OK-GETKNGS	
	1899 IF109 000640	CM+KANDURZ	
A TELEFORM THEORY THEORY THEORY THEORY THEORY THEORY THEORY TO CONTINUE THEORY	000007341	CHITRANDORIS	
COMMENT PANCET PECAP INC. PARCET IN DAILOR	000000	CR+KANDUR4	
DITTEL TEARING OF NOT HADERING VISITING ENGINE	08000	CM+KANGE Z	
KEAL IXVICIO	069000	CM+RANGE 3	
CUMMON / RNGLUS/ HRP, HPP, HRHGCL, CRHGD(11,2), SEGLOS(11,11),	000240	CM+RNGLDS2	
I RNGCLB(II), VELTBL(2,2)	000120	CM+RNGLUS3	
COMMUNI ZRPLCINZ KREP, MREP, KPF, MRF, NVEHKL	000220	CM+RPLCTN2	
COMMON /TARGET/ TVEL, HVEHCL, DISRVH, ITGITP, IMUTS, ITGIPS	00100	CM+TARGET2	
COMMON /TIME/ DURLOS, TIMNOW, TOF, TBR, TIMRA, TIMRAL	001020	CM+TIME 2	
COMMON /WEATHR/ PRCLCG, PRCFLS(2), PRGCFL(11,2), W(6,11,2),	001000	CM+WEATHR2	
1 VIS(11), CLOUD(6), MCC, MVL, PASQL(6), WNDSPD(3,3), HUMID(2),	001010	CM+WEATHR3	
2 WSUM(2), WCFSUM(2), ICC, IVL	001080	CM+WEATHR4	
	013240	SR-GETRN11	
CALL SMPLCD (CRMGD:11,2,2,2,HEP:IR6,DTRNG:IRC)	013250	SP-GETRN12	
	013260	SR-GETRN13	
DO 100 I=1, NRNGCL	013270	SR-GETRN14	
IF (DTRHG.LE.RNGCLR(I)) GO TO 110	013280	SR-GETRN15	
100 CHATINUE	013290	SP-GETRN16	
	013300	SR-GETRN17	
110 IROW=1+1	013310	SR-GETRN18	
	013320	SR-GETRN19	
IF (TVEL.6T.0.0) GO TO 120	013330	SR-GETRN20	
CALL STRACE	013340	SP-GETRN21	
STOP 'IN GETRNG: TARGET VELOCITY = 0.0 "	013350	SR-GETRN22	
	013360	SR-GETRN23	
IZO CALL SMPLCD (SEGLOS,II,II) IRON,NPP,IR7,SEGLNG,ICLASS) DUPI DS={SFGLNG+FIDAT(NVEHCL-1)*PISRVH}/IVFI	013370	SR-GETRN24	
CARLOS - 101 OF 100 LONG OF TANDES DATE OF THE PARTY OF T	000010	ON OCCUPANCE	
	013390	SR-GETRN 26	
ME TOWN	013400	SK-GEIKNZ	
:	013410	SR-GETRN28	
END.	013420	SR-GETRN29	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 34 OF 82)

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SR-6ETT122
SR-6ETT123
SR-6ETT124
SR-6ETT125
SR-6ETT125
SR-6ETT129
SR-6ETT130
SR-6ETT131
SR-6ETT133
SR-6ETT134
SR-6ETT135
SR-6ETT135
SR-6ETT135
                                                                                                                                                                              CM+RSPICONS
CM+RSPIIMZ
CM+RSPIIM3
CM+RSPIIM4
CM+RSPIIM5
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SR-GETTI40
SR-GETTI41
SR-GETTI42
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SR-GETT144
                                                                                                     CM+LOGFLG2
CM+LOGFLG3
CM+RANDOM2
                                                                                                                                                                                                                                                                                                                                                                       SR-GETT118
SR-GETT119
                                                                                                                                                   CM+RANDOM3
CM+RANDOM4
                                                                                                                                                                                                                                                             CM+TIME 2
SR-GETTI12
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                                                                         CM+FSRESP2
CM+KTEST 2
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COMMON /FSRESP/ FSRIGL+2
COMMON /KTEST/ KTEST(20,6)
COMMON /KTEST/ KTEST(20,6)
COMMON /KTEST/ KTEST(20,6)
COMMON /KTEST/ KTEST(20,6)
COMMON /KDGELG/ FTRSTL, SEQUML, SPCL(70), SHRTEC, FTSILL
LOGICAL FIRSTL, SEQUML, SPCL, SHRTEC, FTSILL
COMMON /RANDOM/ IRL, IR2, IR2, IR3, IR4, IR5, IR6, IP7, IR8, IP9, IR10, 000510
COMMON /RANDOM/ IR2, IR25, IR25, IR25, IR16, IR17, IR19, IR20, IR21,000650
2 , IR22, IR23, IR24, IR25, IR25, IR27, IR18, IR19, IR20, 000640
COMMON /RPLCTHV/ KEEP, HREP, KRF, HRF, NVEHKL
COMMON /RSPTIN/ BARTHH3), XHVADE(2), DUML, BCSPTM(2,2), XHTIM(2,000770
COMMON /RSPTIN/ BARTHH3), XHVADE(2), DUML, BCSPTM(2,2), DETTIM, 000800
2 PRSPTH, TRAR, PRSDT, PRSVT, ALFHA(2,2), BETA(2,2), DETTIM, 000800
                                                                                                                                                                                                                                                                                                                                                                                   013610
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                           COMMON /FLAG/ EMPREP, IPN, IPREPL, IDIGTL, IPRTY, IRNDAC, IT3FLG,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       THIRD METHOD OF MODELING PESPONSE TIME (ADDING CONTRIBUTIONS OF
                                                                                                                                                                                                                                                                                                                                                                                   FIRST NETHOD OF MODELING RESPONSE TIME (A SINGLE DISTRIBUTION)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   SECOND METHUD OF MODELING RESPONSE THE (A SINGLE VALUE)
                                                                                                                                                                                                                                                             COMMON /TIME/ DURLOS, TIMNOW, TOF, TBR, TIMPA, TIMRAL
                                                                                                                                                                                                                                                                                                                                                                                                                                              CALL SMPLCD (FSRT,14,2,2,14,1R9,FSPTIM,1C)
TIMHOW=TIMHOW+FSPTIM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 KTEST(8,KRF)=KTEST(8,KRF)+1
IF (PN10,LE,PRSDT) GO TO 170
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              KTEST(8, KRF)=KTEST(8, KRF)+1
IF (RIII0.LE.PRSDT) GO TO 170
                                                                                                                                                                                                                                                                                              ITIMOL=3
IF (FTSILL) ITIMDL=1
IF (PRSPTH.ME.0.0) ITIMOL=2
                                                                                                                                                                                                                                                                                                                                                          Gn TO (100,110,120), ITIMDL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         CALL ABRITL (IARPI)
GN IN 180
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           IABPT=8
CALL ABRTTL (IABFT)
60 TO 180
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                RH10=(1RAH31(1P10)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   R1110=URA1131 (TE.10)
 SUBPOUTINE GETTIN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     110 TIMNOW=PPSPTM
                                                                                                                                                                                                                                                                                                                                                                                                                       100 TIMNUW-DFTTIM
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM (PAGE 35 OF 82)

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VARIOUS DELAY COMPONENTS!

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COLUMN NUMBERS

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COLUMN NUMBERS (PEAD VERTICALLY)
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SR-GETTI 40
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SR-GETTI 77
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                                                                                               OPPORTUNITY
                                                                           IF IDN * 1 , DAYTIME; IF IDN = 2 , HIGHT ,

IF IPREPL = 1 , PRE-PLAHHED; IF IPREPL = 2 , TARGET OF OPPORTUNI

IF IDIGTL * 1 , USF PMD ; IF IDIGTL * 2 , USE VOICE .

IF IPRIY=2, PRIJBITY PPE-PLAHHED TARGET; OTHERWISE, NOT PRIDRITY
                                                                                                                                                                                                                                                                                                                                                                                                          IF (IDIGTL.EQ.2) GD TD 150
TIMNOW=TIMNOW+XMTTIM(ITDGTL,IPREPL)+XMVADF(IPREPL)
ITDGTL=2
                                                                                                                                                                                                    ALF=ALPHA(IDN,IPREPL)
EDDIM-BETA(IDN,IPREPL)*GAMNA(ALF,IP9)
IIMNOW-TINHOW+EDDTIM
                                                                                                                                                                                                                                                        RN10+URAH31(IR10)
IF (RN10.GT.PRSPT) GO TO 130
TIMUON=TINNOW+XNTTIM(ITDGTL,IPBFPL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                           TIHNOW=TINNOW+XMTIN(ITDGTL,IPREPL)
TIMNOW=TINNOW+BCSPTH(ITDGTL,IPPEPL)
TIMNOW=TINNOW+BATRIN(IPPEPL+IPRIY)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         KTEST(9, KRF) = KTEST(9, KRF) + 1
PH12 = URAN31(IR12)
IF (PN12 + LT + PCRNSC) GN TN 1R0
                                                                                                                                                                                                                                                                                                                          RMII=URAN31(IRII)
IF (RMII-LE.PRSVT) 60 TO 140
                                                                                                                                              ITDGTL*IDIGTL
KTEST(8,KRF)=KTEST(8,KPF)+1
IF (ITDGTL.NE.1) CO TO 130
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  CHECK FOR CORRECT MESSAGE
                                                                                                                                                                                                                                                                                                                                                                    CALL ABRITL (IARRI)
GO TO 180
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               CALL ABRITL (IABRI)
                                                                                                                                                                                                                                                                                                  TO 160
                                                                                                                                                                                                                                                                                                                                                                                                                                                 6n TO 160
                                                  120 CONTINUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 36 OF 82)

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SR-GETVI46
SR-GETVI47
SR-GETVI48
SR-GETVI49
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SR-GETVI24
SR-GETVI25
SR-GETVI25
SR-GETVI27
SR-GETVI29
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SR-GETVI31
SR-GETVI33
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SR-GETVI41
SR-GETVI42
SR-GETVI43
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SR-GETVI45
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SR-6ETV113
SR-6ETV114
SR-6ETV115
SR-6ETV116
SR-6ETV117
                                                                                                                                                                                                                                                                                   SR-GETVI18
SR-GETVI19
SR-GETVI20
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SR-GETVI37
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SP-6ETVI 39
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SR-GETVI22
                                                                                                           CM+PANGE 2
CM+RANGE 3
CM+RPLCTN2
     SR-GETVI S2
SR-GETVI S3
SR-GETVI S4
SR-GETVI S5
SR-GETVI S6
CM+RANDOM2
                                                                                                                                                                             CM+WEATHR4
                                                                                   CM+RANDOM3
                                                                                               CM+RANDOM4
                                                                                                                                                    CM+WEATHR2
                                                                                                                                                                  CM+WEATHR3
                                                                                                                                                                                           SR-GETVI11
C THIS SUBRDUTINE SAMPLES WEATHER DATA ARRAY TO DRITAIN CLOUD CEILING 014400 SR-C CAND VISIBILITY RANGE LIMIT.

C AND VISIBILITY RANGE LIMIT.

C CHMON /RANDOM/ IP1, IR2, IP3, IP4, IR5, IR6, IR7, IR8, IR9, IP10, 000640 CM+R I IR11, IR12, IR13, IR15, IR15, IR17, IR18, IR9, IR10, 000640 CM+R C COMMON /RANGE/ DTRNG, WXDRNG, VISLIM, RHGNOW COMMON /RANGE/ DTRNG, WXDRNG, VISLIM, RHGNOW COMMON /RATHK/ KEFP, HRF, NVEHKL COMMON /RATHK/ KEFP, HRF, NVEHKL COMMON /RATHK/ KEFP, HREP, RRCFL(11,2), W(6,11,2), WCFSUM(6), HCC, NVL, PASQL(6), WNDSPD(3,3), HUMID(2), O01000 CM+WE
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USE W ARRAY PROBABILITIES IN SAMPLING TO OBTAIN ICC AND IVE
                                                                                                                                                                                                                                                                                                                                                                                  CLOUD FREE LINE-DF-SIGHT
USE PRECFL ARRAY PPORABILITIES IN SAMPLING TO OBTAIN IVL
SET ICC TO MAXIMUM CLOUD CFILING ALTITUDE INDEX (ICC-6)
                                                                                                                                                                                                                                                                                       THERE IS A CLOUD FREE LOS, ICFLOS-1;IF NOT, ICFLOS-2
                                                                                                                                                                                                           IF THERE IS A CLOUP CEILING, ICLNGF=1; IF NOT, ICLNGF=2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         CALL STRACE
STOP ' IN GETVIS: RANDOM NUMBER TPOUBLE 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   PR=PP+PRGCFL(IJ,ICLNGF)
IF (PRI,LF,RM,AMD,RN4,LI,PR) GN TO 110
                                                                                                                                                                                                                                                                                                                      RN3=URAH31(IR3)
ICFL03=Z
IF (RN3-LI-PRCFLS(ICLNGF)) ICFL03=1
IF (ICFL03-E0,2) GN IN 120
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  PR=0.0
PH4=URAN31(IR4)*WCFSUM(ICLNGF)
                                                                                                                                                                                                                                                              IF (PM2.LT.PRCLCG) ICLMOF=1
                                                                                                                                                                                                                                                                                                                                                                                                                                              CCDCC=CCOUD(ICC)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            DO 100 IJ=1,NVL
                                                                                                                                                                                                                                          RN2=UP.AN31(IP.2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                110 VISLIM*VIS(IJ)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           69 TO 160
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              CONTINUE
                                                                                                                                                                                                                                                       ICLNGF=2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            120 PR=0.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           PP.1=PR
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

COLUMN NUMBERS (READ VERTICALLY)

(PAGE 37 OF 82)

9 COLUMN NUMBERS 10 (READ VERTICALLY)	1065321	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2 1 0 0 9 8 7 0
7888888888 70123456789	SR-GETVI51 SR-GETVI53 SR-GETVI53 SR-GETVI54 SR-GETVI55 SR-GETVI55	SR-GETVISO SR-GETVISO SR-GETVISO SR-GETVISO SR-GETVISO SR-GETVISO SR-GETVISO	SR-GETVION SR-GETVION SR-GETVION SR-GETVION SR-GETVION SR-GETVION SR-GETVION SR-GETVION SR-GETVION
6666666667777777777777777777777777777 01234567890123456789	014880 014890 014910 014910 014930 014930	014950 014970 014980 014980 015000 015010 015010	015050 015050 015050 015050 015080 015080
0000000011111111112222222333333334444444455555555666666667777777778888888888	RH5=URAN31(IR5)*WSUM(ICLNGF) DD 140 I=1,NCC DD 130 J=1,NVL PR1=PE PR=PR+W(I5J,ICLNGF) IF (PR1,LE.RM5,AND.RH5,LT.PP) GD TO 150 130 CONTINUE 140 CONTINUE	C CALL STRACE STOP ' IN GETVIS: RANDON NUNBEP TRONBLE 2 * C 150 VISLIM=VIS(J) IVL=J ICC=I	C 160 ICC=7-ICC C RETURN C END

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 38 OF 82)

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CH+RECNAM2
CM+R PCLONA
CM+R PCLONA
CM+R PCINA
CM+R SP TIM3
CM+R SP TIM3
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SR-HEADE34
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SR-HEADE41
SP-HEADER2
SP-HEADER3
CN+6DL 2
CN+D ISPL 72
CM+FLAG 2
CM+FLAG 4
CM+FLAG 4
CM+HEADNG2
CM+HEADNG3
CM+HGADNG3
CM+HGADNG3
CM+HGADNG3
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CM+PEDESC2
CM+RANGE 2
CM+RANGE 3
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SP-HEADE 29
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SR-HEADE 43
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                                                                COHMON / BAIL/ BLORNG, IBAIL
COHMON / DISPLY/ CIBERT(13,20), CONBUF(13), ICRNT, NTRC
COHMON / DISPLY/ DISPL(24), DISPRIL2), RFCLBL(8), TWILL(8)
COMMON / FLAG/ ENDREP, IDN, IPREL, IDIGTL, IPRITY, IRNDOC, ITSFLG, 000230
CH+G
COMMON / FLAGA/ ACQBEL(2,4), DAYLBL(2), DFSLBL(2), DGTLBL(2,2),
COMMON / LIGADNG/ ACQBEL(2,4), DAYLBL(2), DFSLBL(2), DGTLBL(2,2),
COMMON / LIGADNG/ ACQBEL(2,4), DAYLBL(2), DFSLBL(2), DGTLBL(2,2),
COMMON / LIGADNG/ ACQBEL(2,4), DAYLBL(3,3)
COMMON / LIGATL, SEGNIL, SEGNIL, SPCL(70), SHRTEC, FISIL
COMMON / LIGATL, SEGNIL, SEGNIL, SECUTOD, SHRTEC, FISIL
COMMON / PROSTL, SEGNIL, SEGNIL, SEGNIL, SPCL(70), SHRTEC, FISIL
COMMON / PROSTL, SEGNIL, SEGNIL, SEGNIL, SEGNIL
COMMON / PROSTL, ACGBER, REL, DEFB, TGTHD, SKSEN
COMMON / PROSTL, ANGLET, GTRIG, RELL, DEFB, TGTHD, SKSEN
COMMON / PROSTL, RELL
COMMON / PROSTL, ANGLET, SEGNIL, SEGNIL, SCOPSO
COMMON / PROSTL, SEGNIL, SEGNIL, SEGNIL, SKSEN
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COMMON /SYMBOL/ BLANK, DECPNI, ALFRET(27), ANUMBR(11), SEP(5),
1 DOLLAR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  COMMON TARGET TVEL, NVEHCL, DISBUH, ITGITP, IMUTS, ITGIPS COMMON TIME/ DUBLOS, TIMNON, TOF, TBR, TIMPA, TIMRAL COMMON /UVALUE/ U(70), UPRI, UDI, UIDM, UIDIGI, USMK(2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DIMENSION ABUT(4,40), BOUT(4,40), COUT(4,40) DIMENSION CH(10), RECODE(8) DIMENSION UVALUE(70)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                ENCODE (40,420,ADUT(1,1+NXTLIN))
ENCODE (40,430,ADUT(1,2+NXTLIN))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    (40,440,ADUT(1,3+NXT(IN))
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EQUIVALENCE (RECODE(1), WC ODF)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        WRITE (6,400) NCASE WRITE (6,410) NRFP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            DO 100 J=1,40
ADUT(I,J)=BLANK
BOUT(I,J)=BLANK
COUT(I,J)=BLANK
                 SUBPRUTINE HEADER
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DU 100 J=1,4(
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 39 Of 82)

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SR-HEADE 49
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SR-HEADE91
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SR-HEADE 59
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SP-HEADE89
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                                                                 EHCODE (40,430,ANUT(1,4+NXTLIH))
ENCODE (40,450,ANUT(1,5+NXTLIH)) ITGTTP
ENCODE (40,460,ANUT(1,5+NXTLIH)) ITGTTP
ENCODE (40,470,ANUT(1,5+NXTLIH)) INSBVH
ENCODE (40,480,ANUT(1,8+NXTLIH)) ITVEL
NXTLIH=1

NXTLIH=1

NXTLIH=1

NXTLIH=1

ENCODE (40,200,ANUT(1,NXTLIH+R)) IGTHD
ENCODE (40,430,ANUT(1,NXTLIH+R)) PEFI
ENCODE (40,430,ANUT(1,1,10+NXTLIH))
ENCODE (40,420,ANUT(1,1,10+NXTLIH))
                                                                                                                                                                                                                                                                                                                                                                    ENCODE (40, 420, AQUT(1, 12+NXTLIN))
ENCODE (40, 430, AQUT(1, 13+HXTLIN))
ENCODE (40, 430, AQUT(1, 15+HXTLIN))
ENCODE (40, 430, AQUT(1, 15+HXTLIN))
ENCODE (40, 510, AQUT(1, 15+HXTLIN))
ENCODE (40, 520, AQUT(1, 12+HXTLIN))
ENCODE (40, 520, AQUT(1, 13+HXTLIN))
ENCODE (40, 530, AQUT(1, 19+HXTLIN))
ENCODE (40, 530, AQUT(1, 18+HXTLIN))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       MXTLIN=NXTLIN+1
ENCODE (40,320,AQUT(1,HXTLIN+19) )ANGLET
NXTLIN=NXTLIN+1
EHCODE (40,330,AQUT(1,HXTLIN+19) )PFB
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ENCODE (40,420,400T(1,23+HXTLIN))
ENCODE (40,430,400T(1,24+HXTLIN))
ENCODE (40,540,400T(1,25+HXTLIN))
ENCODE (40,540,400T(1,25+HXTLIN))
IF (113fL6,Eq.0) GO TO 10
ENCODE (40,550,400T(1,27+HXTLIN))
ENCODE (40,560,400T(1,27+HXTLIN))
ENCODE (40,560,400T(1,27+HXTLIN))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          (40,340,AMUT(1,NXTLIN) )SKSEN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 (40,430,ANUT(1,20+NXTLIN))
(40,420,ADUT(1,21+NXTLIN))
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EMCODE (40,430,ADUT(1,NXTLIM)
NXTLIM=NXTLIM+1
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ENCODE (40,420,80UT(1,1))
ENCODE (40,430,80UT(1,2))
ENCODE (40,580,80UT(1,3))
EHCODE (40,430,80UT(1,4))
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CONTINUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 40 OF

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(PRSPTM.EQ.0.0) GU TU 130

NXTL III=5

COLUMN NUMBERS (READ VERTICALLY)

SP-HEADE 95 SR-HEADE 96 SR-HE ADE 97 SR-HFADE 98

016040 016070

016060

COLUMN NUMBERS (READ VERTICALLY)

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SR-HEADD 90
SR-HEADD 101
SP-HEADD 101
SR-HEADD 104
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SR-HEADD 107
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SR-HEADD 111
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SR-HEAD147
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                           ENCODE (40,400,BUDT(1,HXTLIM))
ENCODE (40,600,BUDT(1,HXTLIM+1))
ENCODE (40,600,BUDT(1,HXTLIM+2))
ENCODE (40,600,BUDT(1,HXTLIM+3)) IDSGTP
ENCODE (40,600,BUDT(1,HXTLIM+3)) IDSGTP
ENCODE (40,600,BUDT(1,HXTLIM+5)) RLORNG
ENCODE (40,700,BUDT(1,HXTLIM+5)) RLORNG
ENCODE (40,700,BUDT(1,HXTLIM+5)) (BULBL(1,IDULDC),I=1,3)
ENCODE (40,420,BUDT(1,HXTLIM+7))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            DE (40, 420, BDUT(1, MXTLIN+10))
DE (40, 430, BDUT(1, MXTLIN+11))
DE (40, 430, BDUT(1, MXTLIN+13))
DE (40, 430, BDUT(1, MXTLIN+13))
DE (40, 430, BUUT(1, MXTLIN+13))
DE (40, 430, MUN(12, MXTLIN+14))
DE (40, 430, BUUT(1, MXTLIN+15))
DE (40, 420, BUUT(1, MXTLIN+15))
                                                                                                                                                                                                                                      ENCODE (40,260,80UT(1,4XTLIN) )PCRMSG NXTLIN=NXTLIN+1
                                                                                                                                                                                                                                                                 ENCODE (40,270,800T(1,11XTLIH) )PROOW HXTLIH=HXTLIM+1
ENCODE (40,430,801T(1,NXTLIH) )
NXTLIH=NXTLIN+1
                                                                                                                                                                      HXTLIN-NXTLIN-1

IF (FTSILL) 60 TO 150

IF (FSSPIN-6T-0.0) 60 TO 150

ENCODE (40.650, ROUT (1, NXTLIN) ) PRSVT

HXTLIN-NXTLIN+1
                                                                                                                                                                                                                                                                                                                                                                ENCODE (40,420,BOUT(1,HXTLIH))
NXTLIN=NXTLIN+1
        ENCODE (40,500,800T(1,5) )PRSPTM
                                                                                                                                                                                                                                                                                                                           ENCODE (40,420,800T(1,NXTLIN)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         HXTLIN=HXTLIN+1
ENCODE (40,420,COUT(1,1))
FHCODE (40,430,COUT(1,2))
ENCOPE (40,750,COUT(1,3))
FHCOPE (40,430,COUT(1,4))
                                                                                                                                                                                                                                                                                                                                                         NXTL IN=NXTL IN+2
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ENCODE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 41 OF 82)

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COLUMN NUMBERS (READ VERTICALLY)
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SR-HEAD153
SR-HEAD154
SR-HEAD155
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SR-HEAD158
SP-HEAD159
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SR-HEAD165
SR-HEAD166
SR-HEAD167
SR-HEAD168
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SR-HEAD172
SR-HEAD173
SR-HEAD175
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AD163
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SR-HEAD161
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SR-HEAD202
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IF (IOVER(22),EQ.2) FNCODE (40,850,COUT(1,NXTLIH+7) )
HCODE (40,860,COUT(1,NXTLIH+8) )(ROLBL(1,IPNDOC+1),I=1,4)
NXTLIH=NXTLIN-1
EHCODE (40,430,COUT(1,HXTLIH+8) )
                                                                                                                                                                                                         ENCODE (40,420,CNUT(1,NXTLIN+3))
ENCODE (40,430,CNUT(1,NXTLIN+4))
ENCODE (40,430,CNUT(1,NXTLIN+5))
ENCODE (40,430,CNUT(1,NXTLIN+6))
IF (IVVER(22),NE.0) GD TD 180
DECODE (10,820,UVALUE(22)) ITRRN
ENCODE (40,830,CNUT(1,NXTLIN+7)) (ACQLBL(1,ITRN),I=1,2)
                                                                                                                            (IDVER(21).59.1) ENCODE (40,790,CDUT(1,5) )UVALUE(21)
(IDVER(21).69.2) ENCODE (40,R00,CDUT(1,5))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DG 230 I=1,8
IF (IOVER(20+1),EQ.0) GG TG 230
IF (IOVER(20+1),EQ.1) GG TG 220
IF (IOVER(20+1),HE.2) STGP IH HEADER: EPPOR NUMBER
EMCDDE (100,360,CM(1)) TMPLRL(1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               IF (SPCL(32)) 60 TO 200
NXTLIN=NXTLIH+1
ENCODE (40,880,COUT(1,HXTLIH+17) )NSHK2,NSHK5
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             IF (IDN.EQ.1.AND.YWTHR.FQ.4H2200) ICMFLG=1
IF (IDN.EO.2.AND.YWTHR.HE.4H2200) ICNFLG=1
IF (ICMFLG.EQ.0) GN TO 210
ENCODE (100,260,CM(1) )PAYLBL(IDN),YWTHR
CALL COMMNT (CM.10,FALSE.,,FALSE.)
                                                                                                                                                                                                                                                                                                                                                                                                                         ENCODE (40,420,COUT(1,HXTLIN+13))
ENCODE (40,430,COUT(1,HXTLIN+15))
ENCODE (40,430,COUT(1,HXTLIN+15))
ENCODE (40,430,COUT(1,HXTLIN+15))
ENCODE (40,4350,COUT(1,HXTLIN+15))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       ENCODE (40,890,COUT(1,NXTLIH+18) ) PNSTKL ENCODE (40,430,COUT(1,NXTLIH+19) ) ENCODE (40,420,COUT(1,NXTLIH+20) )
                                        IF (IDVER(21)*NF.0) GD TD 160
DECODE (10,760*UVALUE(21) XUITHE,YWITHR
THOODE (40,770*CHUI(1,5) XWITHR
EHCODE (40,780*CHII(1,5) XWITHR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 CALL COMMINT (CM.10. FALSE., FALSE.)
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ENCODE (40,420,COUT(1,NXTLIN+11))
                                                                                                                                                      NXTLIN=6
ENCODE (40,430,COUT(1,NXTLIH))
ENCODE (40,420,COUT(1,NXTLIH1))
                                                                                               NXTLIN=7
GD TD 170
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 42 OF 82)

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COLUMN NUMBERS (READ VERTICALLY)
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FORMAT (16H PEDATA FOR: TR=,F4.0,4H DT=,11,5H VEL=,F2.0,5H GTR=,F3017560
1.0,6H REFL=,F4.2,8H ANGLET=,F4.0,6H DEFR=,F4.0,7H 1GTHD=,F3.0,7H S017570
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270 FORMAT (111*,2511 PROB DO WARNED TO LASE =, F6.3,7%,114*)

280 FORMAT (111,10HCHOICE OF ,A10,5311 FOR RESPONSE TIME DATA IS INCONSOIT

280 FORMAT (111*,16H TARGET HEADING=,F4.0,8H DEGREES,10%,114*)

280 FORMAT (111*,2311 TARGET HEADING=,F4.0,8H DEGREES,10%,114*)

310 FORMAT (111*,2311 TARGET HEADING=,F4.0,3H KM,5X,114*)

320 FORMAT (111*,26H NOMINAL GUN-TARGET PANGE=,F4.0,3H KM,5X,111*)

340 FORMAT (111*,26H SHORE TE,F4.0,8H DEGREES,17%,111*)

350 FORMAT (111*,26H SRORE SHORE SHOW)

350 FORMAT (111*,26H PROB SHORE KILLS MISSION=,F4.2,8%,114*)

360 FORMAT (111*,26H PROB SHORE KILLS MISSION=,F4.2,8%,114*)

360 FORMAT (111*,26H PROB SHORE KILLS MISSION=,F4.2,8%,114*)

370 FORMAT (111*,26H PROB SHORE KILLS MISSION=,F4.2,8%,114*)

370 FORMAT (111*,26H PROB SHORE KILLS MISSION=,F4.2,8%,114*)

370 FORMAT (111*,26H PROB SHORE MISSION=,F4.2,8%,114*)

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370 FORMAT (111*,26H PROB SHORE MISSION=,F4.2,8%,114*)

370 FORMAT (111*,26H PROB SHORE MISSION=,F4.2,8%,114*)

370 FORMAT (111*,26H PROB MAHED: MISSION=,F4.2,8%,114*)

370 FORMAT (111*,26H PROB MAHED: MISSION=,F4.2,8%,114*)
                                                                                                                                                                                                                                  DO 240 J=1,36
WRITE (6,900) (ARUT(1,J),I=1,4),(ROUT(1,J),I=1,4),(COUT(1,J),I=1,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           (114*) 16X.56HTARGET, 16X,1H*)
(114*,6H TYPE ,12,30X,1H*)
(114*,2CH HUMBER OF VEHICCES=,12,16X,1H*)
(114*,32H MEAN DISTANCE BETHEFN VEHICLES=,F4.0,3HM (114*,17H TARGET VELOCITY=,F2.0,6H M/SEC,13X,1H*)
(114*,17H TARGET VELOCITY=,F2.0,6H M/SEC,13X,1H*)
        D ENCORE (100,370,CM(1) )RECNDE(I),THPLBL(I)
CALL COMMNT (CM,10,.FALSE.,.FALSE.)
IF (1.NE.6) G7 77 230
DECODE (10,380,RECODE(6) )RECHK
IF (PECHK.NE.4HPE00) G0 70 230
CALL PIDNT (11,12,73,74,75,76,77,78,79,PECODE)
CALL COMMNT (CM,10) 71,12,73,74,75,76,77,78,79
CALL COMMNT (CM,10),FALSE.,FALSE.)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  LOH* * * * * ),/)
FORMAT (1H ,1X,23HNUMBER OF REPLICATIONS=,15,/)
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                                                                                                                                                                                                                                                                                                                 WRITE (6,910)
IF (ICMNT.NE.0) WPITE (6,920)
PD 250 J1, ICMNT
WPITE (6,930) (CMFNT(I,J),I=1,13)
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM

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018000
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017870
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            MAI (1119-234) NUMBER OF TOWN THE STATE ST
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               $$ ),8X,15HC O M M E N T S,9X,6(8H $$
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            (14*,14%,10HinBSCUDANTS,14%,114*)
(14*,244 VOLUME UF SMOKE FIPED: ,14,34 + ,14,3%,14*)
(14*,254 PROB DUST KILLS MISSION=,64,2,9%,14*)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            (1H*)32H PROB SUPPRESSED BY DIRECT FIRE: 1X, A4, 2H *) (1H*)16X, 7HWEATHER, 15X, 1H*)
(1H*,33H NUMBER OF POINDS PER ENGAGEMENT=,12,3X,1H*)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (14*,10H MONTH OF ,A3,25X,1H*)
(114*,14H THE OF DAY: ,A4,20X,1H*)
(114*,27H OVEREIDE WITH WICHTHER REC ,A10,2H *)
(114*,32H USING "TEHPORARY" WEATHER DATA ,6X,1H*)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              (1H*,1X,2A10,17X,1H*)
(1H*,27H DVEPRIDE WITH TERFAIN PEC ,A10,2H *)
(1H*,31H USING "TEMPORAPY" TERPAIN DATA,7X,1H*)
(1H*,1X,3A10,A7,1H*)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  (1H*,11X,15HTEPAIN AND 1 OS,12X,1H*)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (1H , 2X, 4A10, 3X, 4A10, 3X, 4A10)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           220 FORMAT (IH ,6(8H%s
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         FORMAT (1H ,13A10)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                (6X, 12, 2X)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               (A3, A4, 3X)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    (6X, 12, 2X)
                        510 FURNAT

520 FORMAT

550 FORMAT

550 FORMAT

600 FORMAT

600 FORMAT

610 FORMAT

620 FORMAT

620 FORMAT

620 FORMAT

620 FORMAT

640 FORMAT

640 FORMAT

640 FORMAT

640 FORMAT

640 FORMAT

640 FORMAT

720 FORMAT

740 FORMAT

740 FORMAT

740 FORMAT

740 FORMAT

750 FORMAT

760 FORMAT

860 FORMAT

870 FORMAT

870 FORMAT

870 FORMAT

870 FORMAT

870 FORMAT
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910 FORMAT
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

COLUMN NUMBERS (READ VERTICALLY)

(PAGE 44 0F 82)

```
SR-HITCHKS
SR-HITCHK3
CN+HIT 2
CM+HIT 3
CM+HIT 4
CM+KIEST 2
CM+KTEST 2
                                                                                                                                                               CM+RANGE 2
CM+RANGE 3
CM+RPLCTN2
                                                                                                                                                                                                                     CM+RSPTIM3
CM+RSPTIM4
CM+RSPTIM5
CM+TARGET2
                                                                                                                                                                                                                                                                                                                                                                                                                   SR-HITCH21
SR-HITCH22
SR-HITCH23
                                                                                                                                                                                                                                                                                                                                                                                                                                                          SR-HITCH24
SR-HITCH25
SR-HITCH26
SR-HITCH27
                                                                                                                                                                                                                                                                                                                    SR-HITCH14
SR-HITCH15
                                                                                                                                                                                                                                                                              CM+TIME 2
SR-HITCH12
                                                                                                                                                                                                                                                                                                                                                 SR-HITCH16
                                                                                                                                                                                                                                                                                                                                                                            SR-HITCH18
SR-HITCH19
                                                                                                                                                                                                                                                                                                                                                                                                     SR-HITCH20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SR-HITCH28
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              SR-HITCH29
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SR-HITCH31
SR-HITCH32
                                                                                                                                                                                                                                                                                                         SR-HITCH13
                                                                                                                                                                                                                                                                                                                                                               SR-HITCHI7
                                                                                                                                                      CM+RANDOM4
                                                                                                                                                                                                           CM+RSPTIM2
                                                                                                                                     CM+RANDUM3
                                                                                                                                                               REAL MXDRNG
COMMON / PRICTN/ KREP, NREP, KFF, HPF, HVEHKL
COMMON / PRICTN/ KREP, NREP, KFF, HPF, HVEHKL
COMMON / RSPIH/ RATETH(3), XHVADF(2), DUHL, RCSPIM(2,2), XMIIM(2,000770
1 2), THEAN(2,2), TSIGMA(2,2), BETMA(10,2), NGT, TRARRY(3,2), 000800
2 PRSPIH/ TRBAR, PRSDI, PRSVI, ALPHA(2,2), RETA(2,2), DETIM, 000810
3 IDSGTP, KUHC, PCRMSG, PRDOW
COMMON / TARGET/ TVEL, MVEHCL, DISBVH, ITGTTP, IMUTS, ITGTPS
001000
COMMON / TARGET/ TVEL, MVEHCL, DISBVH, ITGTTP, IMUTS, ITGTPS
001000
                                                                                                                                                                                                                                   000810
000820
001020
018270
018280
018310
018310
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018360
018360
018460
018470
018430
                                           018170
018180
000410
000420
000430
                                                                                                               COMMON /HIT/ INDEX(6,5,2), PETRL(60,10,7), DLTT(6), PKTBL(10,2), I HRUGIT, RHGITF(20), TTF(3,20,2), HRHGPS, PHGPST(10), PSTTBL(10,2,3)
                                                                                                                                                                                                                                                                                                         DO 100 IK=1,HRNGTT
IF (PHGNOW-LT.PHGTTF(IK).DP.PNGTTF(IK+1).LE.PNGNOW) GO TO 100
                                                                                                                                                                                                                                                                                                                                                                                                     110 TFRACL=(RNGHDW-RNGTTF(IRM))/(RNGTTF(IRM+1)-RNGTTF(IRM))
PH=TTF(IDSGTP,IRM,ITGTPS)+TFRAC1*(TTF(IDSGTP,IRM+1,ITGTPS)
1 -TTF(IDSGTP,IRM,ITGTPS))
                                                                                                                                                                                                                                                                                                                                                     GO TO 110
CONTINUE
STOP • IN HITCHK: FAILED TO BRACKET RANGE
                                                                                                                                                                                                                                                                                                                                                                                                                                                              RNZO=URAN31(IR20)
KTEST(18,KRF)=KTFST(18,KRF)+1
IF (RNZO.LE.PH) GO TO 120
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     CALL ABRITL (IABRI)
                                               SUBROUTINE HITCHK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         IABRT=18
                                                                                                                                                                                                                                                                                                                                       IPM=IK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              120 RETURN
                                                                                                                                                                                                                                                                                                                                                                      100
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 45 OF 82)

SUBROUTINE INITLZ	018490	SR-INITL ZZ	
COMMON JABOPT/ NARORT(20,6), MSABLM	000110	CM+ABORT 2	
COMMON /ACHAR/ CHAR(10,120), NPFC	000150	CM+ACHAR 2	
COMMON ADVALUE DE 201, DEPRIS DELL'S DEUTS DE SERVEZE	_	Η.	
COMMIN FELAST EMPREY, 1949 IPREFLY LUISTLY IPRITY IRNOUS, 113FLS) 1 FNDFLG	000310	CM+FLAG 2	
LOGICAL ENDELG, ENDREP	000320	CM+FLAG 4	
COMMON /ICODE/ ICODE	000450	CM+ICODE 2	
COMMON /INDEX1/ INDXII(2001) COMMON /PINDAT/ DAT. TIH, HEASE, ICEPSE, IPPSE	000440	CM+INDEX12 CM+PINDAT2	
CTHMON /UVALUE/ U(70), UPRT, UDT, UIDN, UIDIGT, USHK(2)	001040	CM+UVALUE2	
DIAL ISLUN IRAY (6)	018290	SK-INITEIZ	
DIMERSION INPTAN(70)	018600	SP-INITE 14	
EXTERNAL NIPLEC	018620	SR-INITL15	
	01 86 30	SP-INITL16	
FQUIVALENCE (ICODF, CDDF)	018640	SR-INITL17	
0-117-74-01	018650	SR-INITE 18	
IEAY(5)=LOCF(NOPEC)	018670	SR-INITL 20	
CALL SYSTEMC (104, IRAY)	018680	SR-INITL21	
** ***********************************	018690	SR-INITE 22	
CALL OFFINS (LIMINALISCOLUT)	016210	20 THIT-05	
I CODE = 8HOP THNUMS	018720	SR-INITES	
CALL READMS (11, IOPTIM, 70, ICONE)	018730	SR-INITL26	
	018740	SR-INITL 27	
DU 100 I=1,NREC	018750	SR-INITL28	
CHICKLEL	018700	25-1411-20	
CHAR(Z)]=IOPINM(J)	018770	SR-INITE 31	
	018790	SP-INITL32	
CALL PFAULT	018800	SR-INITL33	
CALL USET	018810	SR-INI TL 34	
	018820	SR-INITL35	
HSARLH=11	018830	SR-INITL36	
ENDFLG=.FALSE.	018840	SR-INITE 37	
	018860	05-INI 16.30	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 46 0F 82)

```
CM+RSPTIM2
CM+RSPTIM3
CM+RSPTIM4
CM+RSPTIM5
CH+RUNDAT2
CM+SMOKED2
CM+SMOKED3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    CM+SYMBOLZ
CM+SYMBOL3
CM+TARGETZ
CM+TIME Z
                                                                                                                                                                                     CM+DVALUEZ
CM+FLAG 2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 CM+PEDESC2
CM+PDINT 2
CM+RANDOC2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          CM+UVALUEZ
CM+WEATHR2
CM+WEATHR3
CM+WEATHR4
                                                                                                                                                                                                                                                                                                                                                                    CM+ICODE 2
CM+INDEX12
                                                                                                                                                                                                                                                                                                                                                                                                             CM+L06FL62
CM+L06FL63
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  CM+RANDOM2
CM+RANDOM3
                                                                                                                                                                                                                                                             CM+FLAG 4
CM+FLTTIM2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            CM+RANDOM4
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               CM+RECNAM3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CM+RNGL052
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           CM+RNGL DS3
                                                                                   CM+COMENT2
CM+DESRNG2
                                                                                                                            CM+DISPLY2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             CM+RECNAM2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                CM+RPLCTN2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               CM+RANGE CM+RANGE
                                                                                                                                                                                                                                                                                                                                                                                                                                                         CM+MISC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                               CM+OVER
                                                                                                                                                                                                                                                                                                       CM+HIT
                                                                                                                                                                                                                                                                                                                               CM+HIT
018890
018900
000110
                                                               000170
000190
000210
000230
000250
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000300
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000420
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000470
000510
000520
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000580
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          COMMONI /RANDOC/ TCRIT, HPLGSR, PHGPLS(10), PPRLOS(10) 000620 COMMONI /RANDOMI/ IE1, IR2, IP3, IR4, IP5, IR6, IR7, IR8, IP9, IR10, 000640 I IR11, IR12, IR13, IR14, IR15, IR15, IP14, IP18, IR19, IP20, IR21000650 Z , IR22, IR23, IR24, IR25, IR25, IR25, IR25, IR25, IR26, IR3000650 COMMONI /RANGE/ DTFHG, MXDPHG, VISLIM, RNGNOW
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           000710
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              COMMON / ZROCE OZ, HEP, HPP, HPHGCL, CPHGD(11,2), SFGLOS(11,11), 000740

1 RNGCLB(11), VELTBL(2,2)

COMMON / ZPLCTH/ KREP, HREP, KRF, HBF, HVEHKL
COMMON / PREDIM/ BATTH(14), 200770

COMMON / PSPTIM/ PATTH(14), 200770

Z PESPTIM/ TRBAR, PRSDT, PRSVT, ALPHA(10,2), HOT, TPARPY(3,2), 000810

Z PESPTIM, TRBAR, PRSDT, PRSVT, ALPHA(2,2), BETA(2,2), DETTIM, 000810

3 IOSGTP, RUHC, PCRHSG, PRDDW
COMMON / SHOKED/ SAKZ(3,3,2), SKKS(3,3,2), FRONT, HSMKZ, NSHK5, 000820

COMMON / SHOKED/ SAKZ(3,3,2), SKKS(3,3,2), FRONT, HSMKZ, NSHK5, 000930
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       000970
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001080
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                                                           COMMON /GAIL/ BLORNG, IBAIL
COMMON /COMENT/ CRENT(13,20), COMBUF(13), ICMNT, NTRC
COMMON /DESRNG/ DESPNG(3,2)
COMMON /DISPLY/ DISPL(3,4), FISPM(12), RECLBL(8), THPLBL(8)
COMMON /DODF/ DEDRL(10,3), NDFSP, NDOKIL, DOKILD
LOGICAL DOKILD
COMMON /DVALUE/ P(70), PRET, DDT, DIDN, DIDGE, DSHK(2)
COMMON /FLAG/ EHRPEP, IDN, IPPEPL, IDIGEL, IPPETY, IRNDGC, ITSFLG,
                                                                                                                                                                                                                                     1 ENDELG
LOGICAL ENDELG, ENDREP
COMNON /FLTIM/ TOFAFY(16)
COMNON /HIT/ INDEX(6,5,2), PETBL(60,10,7), DLTT(6), PKTRL(10,2),
I WRHGIT, RNGTIF(20), TIF(3,20,2), HRNGPS, PNGPST(10), PSTTBL(10,2,3)
COMNON /ICODE/ ICODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            COMMON TARGET/ TVEL, NVEHCL, DISRVH, ITGITP, IMUTS, ITGIPS COMMON TITME/ DUCLOS, ITHHOW, TOF, TRP, ITHPA, ITMRAI COMMON TAXALE OF 1709, UPPF, UDIS, UDISGE, USMC(2) COMMON TAXALE PROCESSION, PFGGFL(11,2), W(6,11,2), I VIS(11), CLUUN(6), HCC, HVL, PASQL(6), WNDSFD(3,3), HUMID(2), Z. WSUMICE, WCFSUM(2), ICC, IVL.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         CONMON /SYMBOL/ BLANK, DECPNT, ALFRET(27), ANUMBR(111), SEP(5),
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             COMMON / RECNAN/ NCIDE, ACCODE, P.SCODE, DECODE, ROCODE, PECODE,
                                                                                                                                                                                                                                                                                                                                                                                   COMMON /INDEXI/ INDXII(2001)
COMMON /LOGELG/ FIRSTL, SEQUML, SPCL(70), SHRIEC, FISILL
LOGICAL FIRSTL, SEQUML, SPCL, SHRIEC, FISILL
COMMON /HISC/ DGARFK, PRSTKL, RELIF
COMMON /DOREAL /INVERTY
COMMON /PEDESC/ ANGLET, GTPMG, REFL, DEFB, TGTHD, SKSEN
COMMON /POINT/ IFOINI(70)
                                           COMMON JABORT/ NABORT(20,6), NSABLM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               PSCHDE, AICHDE
  SUBROUTINE INPUT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               EXTERNAL MOREC
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123456789012345678901234567890123456789012345678901234567890323456789012345678901234567890 COLUMN NUMBERS

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 47 OF 82)

DIM	DIMENSION NCEDITO, CHILD)	001150	DM+L 5	v 2 0	
DIA	FRISTON UVALUE(70), PVALUE(70)	001170	DM+L	۵ م	
EOU	QUIVALENCE (ICODE, CODE)	001100	DM+L	0	
E CALL	E 90] VALENCE (0(1), 0VALUE(1)), (0(1), 0VALUE(1))	.001200	₽#+C ₽M+M	10 2	
MIO	DIMENSION WDATA(193), ACODAT(161), RSPOAT(49), DESDAT(31)	001230	W + W C	ı m v	
0.10	KUDATATEET	001240	E # # # # # # # # # # # # # # # # # # #	4 K	
EQU		001260	DM+M	. •	
EQU	IIVALFHCE (ACQDAT(1), MRP)	001270	M+MO	~ '	
EQU		001280	H+H0	o o	
E QU	EQUIVALENCE (RODATA(1),TORIT)	001300	DM+M	10	
EQU	QUIVALENCE (PSTDAT(1), NRNGPS)	001320	DH+M	12	
EqU	EQUIVALENCE (AINVDA(1), PLTT(1))	001330	DM+M	13	
IEA	Y(1)=0	019240	SE-INPULSA SP-INPULSA	137	
I P. A		019260	SP-INPUT39	139	
CALL	L SYSTEMC (104, IPAY)	019270	SR-INPUT40	140	
00	DG 110 I=1,13	019290	SR-INPUT42	141 142	
COM	COMBUF(I)=BLAHK	019300	SR-INPU	143	
5	DD 100 J=1,20	019310	SP-INPUT 44	144	
110 CON	CONTINUE	019320	SR-INPUT45	145 146	
	00 120 I=1,70	019340	SR-INPUT47	147	
120 NCR	NCRD(I)=0	019350	SR-INPUT 48	148	
ICM	ICMNT=0	019350	SP-INPUTSO	150	
NLP	NLPTC = 0	019380	SR-INPUT51	151	
N T N	NTRC=0	019390	SR-INPU	152	
NC A	MCASE=MCASE+1	019400	SR-INPUT53	153	
MPT	WPITE (8.770) NCASE	019410	CANTILAN	155	
		019430	SR-INPUT56	156	
DU MPE	"PEAD-A-LINE-NF-IMPUT" UNTIL "END","ENDF",OR FOF ENCOUNTEPED	019440	SR-INPU	157	
130 RFA	D (5,870) (A(I),I=1,80)	019450	SP-INPUISE	159	
	IF (FOF(5).FQ.0.0) GO TO 140	019470	SP-INPU	NPUT 60	
E19		019480	SR-INPUT61	161	
171	IN THE TOO BOOK ON THE THEORY IN THE TOO TOOLS OF THE TOO THE TOO TOO TOO TOO TOO TOO TOO TOO TOO TO	019490	SK-INPUI62	162	
CAL	L COMMIT (CM.10, FALSE, , FALSE,)	019510	SR-INPUT64	T64	
0.0	60 TD 490	019520	SR-INPUT65	165	
140 001	100 F=1 1111 1000 01 111	019530	SR-INPUT66	166	
	MKILE (5960) (A(:))1=1980)	019540	SP-INPO	107 168	
i I		019560	SR-INPUT69	169	
	L COMMMI (A, 80, TRME,, TALSE,)	019570	SR-INPUT70	170	
0.0	10 130	019580	SR-INPULZE	173	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 48 OF 82)

COLUMN NUMBERS (READ VERTICALLY) 0000000001111111111222222222333333344444445555555556666666667777777888888889 1234567890123456789012345678°01223456789012345678901234567890123456789012345678901234567890

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SR-INPULOS
SR-INPULOS
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SR-INPULOS
SR-INPULOS
SR-INPULO
SR-INPULIO
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SR-INPUIZZ
SR-INPUIZZ
SR-INPUIZZ
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SR-INPUT89
SR-INPUT90
SR-INPUT91
SR-INPUT92
SR-INPUT93
SR-INPUT94
                                                                                                                                                                                                                      SR-INPUT96
SR-INPUT97
SR-INPUT98
SR-INPUT99
SR-INPUT00
SR-INPUT01
        SR-INPUT73
SR-INPUT74
SR-INPUT75
SR-INPUT76
SR-INPUT77
SR-INPUT79
SR-INPUT79
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SR-INPUT82
SR-INPUT83
SR-INPUT84
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SR-INPUT86
SR-INPUT87
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SP-INPU126
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                                                                                                                                                                                                                                  ENCODE (100, 900, CM(1) )
CALL COMINT (CM.10, FALSE., FALSE.)
IF (IGD. EQ.2.AND.IT(2), EQ.2) GO TO 130
CALL USET
                                                                                                                                                                                                                                                                                                                                                                                   210 WRITE (6,790) (A(I), I=1,80), ITI
STOP ' IN IMPUT: FRROR NUMBER 1
                                                                                                                                                                                                                                                                                                                                                                                                             220 IF (II(2), EQ.1) IPPEG=IT(3)-1
IF (II(2), EQ.2) ICCPFG=IT(3)-1
GO TO 480
                                                                                                                                                                                                                                                                                                                                                                                                                                              SHRTEC=.TRUE.
IF (IT(3).EQ.2) SHRTEC=.FALSE.
GO TO 480
                                                                                                                                                                                                                         IF (NLRTC.NE.1) GO TO 200
                                                                                                                                                                                                                                                                      IF (160, Eq. 2) 60 TO 130
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      IT2=IT(2)
UVALUE(IT2)=B(1,3)
INVER(IT2)=1
                                                                                                                                                                                                                                                                                                          CASE IT1 OF "KEYWORP"
                                                                                                                                                                                              ENDFLG=.TRUE.
                                                                                                                                                                                                        GU TO 490
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 49 OF 82)

D-51

8889 CDLUMN NUMBERS	(READ VERTICALLY)
000000000111111111122222222233333333334444444444	1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890 (READ VERTICALLY)

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SP-1NPU171
SR-1NPU172
SP-1NPU173
SP-1NPU174
SP-1NPU176
SR-1NPU177
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SR-1NPU177
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SP-INPUI69
SR-INPUI70
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SP-INPUIS6
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SR-INPUI59
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DECODE (10,010,0(1,3)) UPRT
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INVER[II]=0
INVER[II]=0
INVER[II]=0
INVER[II]=0
INTO (INT(2)=0.1) GO TO 330
ENCODE (10,850,UVALUE(IT1) ) PFCLBL(IT1-20),II(2),III
UPRT=0.0
UIDIG=II(3)
IFSLL=+FALSE
IF (II(2)=0.1) FISILL=,TRUF.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 IT2=IT(2)
113=IT(3)
10VER[III)=0
ENCODE (10,840,HVALHE(21) )PISPH(IT2),PISPT(IT3),IT1
Of TO 480
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                ENCODE (10,850,UVALUE(IT1) ) PECLBL (IT1-20),IT(2),IT1 IDVER(IT1)=0 GO TO 480
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           ENCODE (10,800,UVALUE(27) )EECLBL(7),IT(2)
                                                                                                                                                                                                                                          260 IT2=IT(2)
IOVER(IT2)=0
IF (MCRD(IT2),En.0) U(IT2)=D(IT2)
Gn Tn 480
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0 IF (IT(2), Eq.1) GO TO 350
UVALUE(31)=1.0
DECUDE (10,910, R(1,2) }PUMC
GO TO 480
GO TO 480
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        360 IF (IT(2).NE.1) GO TO 370
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                280 UVALUE(IT1)=IT(2)
60 TO 480
                                                                                                                                       CALL CREAD (172)
GD TO 480
                                                                                                                                                                                                                                                                                                                                                                                                             UVALUE (11) = IT (2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   10 '
FTSILL=,FALSE.
                                                                       IT2=IT(2)
INVER(IT2)=2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       GD TD 480
          GD TD 480
                                                                                                                                                                                                                                                                                                                                                                                                                                                      67 TO 480
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 50 OF 82)

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                                                                                                                                                     IF (IT(JK),EG.1) USHK(JK-2)=DSHK(JK-2)
IF (IT(JK),NE.1) DECODE (10,910,8(1,JK) )USHK(JK-2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     +
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     *
                                                                                                                                                                                                                                                                                                         IF (II(2).Eq.1) 60 TO 460
SPCL(III)*.TRUE.
DECODE (10,910,8(1,2) )UVALUE(III)
60 TO 470
                                                                                                                                                                                                                                SPCL(ITI)=.TRUE.
DECODE (10,910,8(1,2) )UVALUE(IT1)
                                                                                                            DECODE (10,910,8(1,3) )UVALUE(IT1) 60 TO 480
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DECODE (10,789,100PE) XWTHP
D0 500 I=1,12
IF (XWTHR,NE,DISFN(I)) G0 T0 500
IMNTH=1
           60 T0 480
becope (10,910,8(1,2) )UVALUE(IT1)
60 T0 480
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     *
                                                                                                                                                                                                                                                                                                                                                                                                                                     END OF "READ-A-LINE-OF-IMPUT" LOOP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     #
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       *
                                                    IF (IT(2).EG.1) GN TO 400
SPCL(IT1)=.TRUE.
IF (IT(3).NE.1) GN TO 300
UVALUE(IT1)=DVALUE(IT1)
                                                                                                                                                                                                                   IF (IT(2), Eq. 1) CO TO 430
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       *
UVALUE(IT1)=DVALUE(IT1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       *
                                                                                                                                                                                                                                                                                                                                                                                             END OF "KEYWORD" CASES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       *
                                                                                                                                      SPCL (IT1)= . FALSE.
                                                                                                                                                                                                                                                                                                                                                           SPCL(IT1)=.FALSE.
CONTINUE
                                                                                                                                                                                                                                                                SPCL(IT1)=.FALSE.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     490 CODE=UVALUE(21)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       * * *
                                                                                                                                                  DR 410 JK=3,4
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            GO TO 510
                                                                                                                                                                                                                                                                                          GD TO 480
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                                                                                                                                                                                                                                                          GD TD 440
                                                                                                                                                                                                  GU TO 480
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         500 CONTINUE
510 CONTINUE
                                                                                                      60 TO 480
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                                                                                                                                                                                                                                                                                CONT INUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 51 OF 82)

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COLUMN NUMBERS (READ VERTICALLY)
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SR-INPUZ69
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SR-INPUZ73
SP-INPUZ74
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SR-INPU286
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DD 580 I=1,2
DD 580 J=1,2
AL PHA(I, J)=(THEAH(I, J)/TSIGHA(I, J))**2
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                IT (UNC.LT.3.) IPREPL=1

TRBAR=TRARPY(IPREPL+IPRTV,IDIGIL)+TOF

IF (PRSPTM-NE.O.0) TRRAR=PRSPTM+TOF

IF (TSILL) GO TO 500

IF (PRSPTM-GT.O.0) GO TO 590
                               INTHRL=193
IF (IOVER(21).EQ.2) GO TO 520
CALL READNS (11, VDATA, INTHRL, ICODF)
WCODE=CODE
                                                                                                                                                                                                       IF (IDVER(22), Eq.2) GD TD 560
CALL READMS (11,ACQDAT,IACGFL,ICDDE)
ACCDDE-CODE
                                                                                                                                                                                                                                                                                                                                    IF (IOVER(23), Eq.2) GD TD 570
CALL READMS (11, REPDAT, IRSPRL, ICODE)
RSCODE=CODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   IF (INVER(24).E0.2) GD TD 600
CALL READMS (11.PFSDAT.IDFSRL.ICNDE)
DFCGDF≂CGDE
                                                                                                                            WCFSUM(J)=WCFSUM(J)+PRGCEL(I,J)
DO 540 K=1,NCC
540 WSUM(J)=WSUM(J)+W(K,I,J)
550 CMTINUE
                                                                                                                                                                                                                                                           IGTR=GTRNG+.5
TOF=TOFARY(IGTR)
IF (SPCL(45)) TOF=UVALUE(45)
                                                                                                                                                                                                                                                                                                                                                                                                              IF (UNC.EQ.I.) IPPIY=2
                                                                         DD 530 I=1,2
WSUM(I)=0,0
WCFSUM(I)=0,0
DD 550 I=1,NVL
DN 550 J=1,2
                                                                                                                                                                                                                                                GTRNG=UVALUE(56)
                                                                                                                                                                                   CODE = UVALUE (22)
                                                                                                                                                                                                                                                                                                     CODE-UVALUE(23)
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IRSPRL=49
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 52 OF 82)

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SR-INPU326
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SP-INPU319
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11COPE)
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                                                                                                                                                                   IRNDUC=UVALUE(11)-1.0
IF (IRNDUC,EQ.O.OR,EUVFP(25),FQ.2) GU TU 670
IF (IDVER(25),NE.1) GN TN 650
                                                                                                                                                                                                                                      CALL READNS (11, PSTPAT, TTPSFL, ICODE)
PSCODE-CODE
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                         690 IPERL#4260
CALL READHS (11,PFDATA,IPEPL,ICODE)
PECODE=CODF
                                                                                                                                                                                                                                                                         CALL READMS (11,PODATA,IROPL,ICODF)
ROCODE=CODE
                    IF (.NOT.SPCL(42)) 60 TO 610
TVEL=UVALUE(42)
60 TO 620
610 IXXX=3.0-ABS(2.5-FL0AT(INNTH))
TVEL=VELTRL(IPN,IXXX)
620 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       IF (IOVER(27), Eq. 2) 60 TO 710
                                                                                                          IF (.NOT.SPCL(43)) 60 TO 630 MXDRNG=UVALUE(43)
                                                                                                                                                                                                                       DECODE (10,830,U(22) )ITRRH
ITVEL=TVEL
                                                                                                                                                                                                                                                                                                                         IF (IOVER(26).E9.2) GO TO
IF (IOVER(26).ME.1) GO TO
CODE=UVALUE(26)
                                                                                                                                       MXDRIG=DESRIG(IDSGTP,IDH)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                   680 ATIGLET=UVALUE(46)
                                                                                                  IDSGTP=UVALUE(16)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   CODE=UVALUE(27)
ITPSRL=41
                                                                                                                                                                                                                                                                                                                                                                             REFL=UVALUE(57)
DEFB=UVALUE(58)
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                                                                                                                                   GD TO 640
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COPE PROGRAM - CONT'D

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LISTING D-1 FORTRAN LISTING

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COLUMN NUMBERS
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  IF CCPLOT AND/OR PPLOT ARE IMPLEMENTED AS REAL PLOT PROGRAMS PATHER THAN AS PROGRAM STUBS, THEN THE CALL STATEMENTS TO THEM (BFLOW) SHOULD BE MOVED TO A SURPOUTHY THAT IS CALLED AT THE COMPLETION OF EACH REPLICATION (SUCH AS DUTPUT)
                                                 IF (UVALUE(13).EQ.1.) GN TN 730

NRNGPI-HRNGFS

DO 720 1=1,RRNGFD

If (PSTTEL(1,1).EQ.0.0) GN TO 720

PSTTEL(1,2).PSTTEL(1,2)/(1,-PSTTEL(1,1))

PSTTEL(1,3).=1,-PSTTEL(1,2)

CONTINUE

30 CONTINUE
                                                                                                                                                                                                                                                                 INVOPL=167
CALL READMS (11.AIMVDA.INVOPL,ICODF)
AICODE-CODE
CONTINUE
                                                                                                                                                                                                                                 IF (IOVER(28).E9.2) GH TH 740
CODE=UVALUE(28)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         IF (IPPFG.EQ.1) CALL PPLUT
IF (ICCPFG.EQ.1) CALL CCPLUT
                                                                                                                                                                                                                                                                                                                                                                                                                                            IF (SPCL(32)) GN TN 7
NSMK2*USMK(1)
HSMK5=USMK(2)
CALL PSMOKE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        RELIF=UVALUE(50)
TBR*UVALUE(51)
NREP=UVALUE(52)
NRF=UVALUE(53)
NVEHCL=UVALUE(53)
                                                                                                                                                                                                                                                                                                                                                        ITGTTP=UVALUE(14)
                                                                                                                                                                                                                                                                                                                                                                                                             IT3FLG=UVALUE(31)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    750 PSMKKL=UVALUE(32)
760 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DOARPK=UVALUE(41)
BLORNG=UVALUE(44)
PDSTKL=UVALUE(47)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    PRSVT=UVALUE (48)
PRSDT=UVALUE (49)
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PCRMSG=UVALUE(61)
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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                                                                                                                                                                                                                                                                                                                                                                                                                                          770 FORMAT (1H ,50(1H*), 1X,23HINPUT OPTIONS FOR CASE ,13,1X,50(1H*)) 022910 7780 FORMAT (43,7X) 022920 720 FORMAT (1H ,23H ERROR IN INPUT. LIHE: ,80A1,11H WITH IT1= ,15,/13022930 1H IS IN ERROR ) 022940
                                                                                                                                                                                                                                                                                                                                                                    *** FORMAT STATEMENTS ***
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                                                                                                                                                                  CALL ECHO (8)
                                                                                                                                                                                                                                                      RETUPN
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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SP-LOSCHK2
SP-LOSCHK3
CM+FLAG 2
CM+FLAG 4
CM+KTEST 2
CM+KRANDOC2
CM+RANDOM2
                                                                                                                                                                                                                              CM+RPLCTNZ
CM+TARGETZ
CM+TIME 2
SR-LOSCH12
                                                                                                                                                                                                                                                                                                     SP-LOSCH14
SR-LOSCH15
SR-LOSCH16
SP-LOSCH17
SR-LOSCH19
SR-LOSCH19
                                                                                                                                                                                    CM+RANDOM4
CM+RANGE 2
CM+RANGE 3
                                                                                                                                                                                                                                                                                                                                                                                                            SR-LOSCH21
SR-LOSCH22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      SR-LOSCH36
SR-LOSCH37
                                                                                                                                                                        CM+RANDOM3
                                                                                                                                                                                                                                                                                          SP-LOSCH13
                                                                                                                                                                                                                                                                                                                                                                                             SR-LOSCH20
                                                                                                                                                                                                                                                                                                                                                                                                                                          SR-L OS CH23
                                                                                                                                                                                                                                                                                                                                                                                                                                                        SR-LOSCH24
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   SR-LOSCH28
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SP-L 05 CH 30
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SR-L 05 CH 33
                                                                                                                                                                                                                                                                                                                                                                                                                                                                       SR-LOSCH25
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              SR-LOSCH31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          SR-L 05CH34
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SR-LOSCH27
                                                                                  1 ENDIG

LUGICAL ENFLG, ENDREP

LUGICAL ENFLG, ENDREP

COMMON / REST/ (REST/ REST/20,6)

COMMON / RANDOC/ ICRIT, NPLOYEP, RHGPLS(10), PRBLOS(10)

COMMON / RANDOC/ ICRIT, NPLOYEP, RHGPLS(10), PRBLOS(10)

COMMON / RANDOC/ ICRIT, REJ. IR3, IR4, IF5, IR6, IR7, IR8, IR9, IR9, IR10,000640

1 IR11, IR12, IR13, IP14, IR15, IF16, IR17, IP18, IP19, IR20, IR21000650

2 J IR22, IR23, IP24, IR25, IP26, IR27, IR20

COMMON / RANGE/ DIRHG, MXDRHG, VISLIM, PHGHOW
                                                 023120
023130
000300
                                                                                                                                                                                                                              000170
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023230
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023290
023300
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023250
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023500
023510
                                                                      COMMON /FLAG/ ENPREP, IRM, IPREPL, IDIGTL, IPRIY, IRNDAC, ITAFLG,
                                                                                                                                                                                                                     COMMON TRECTUL KREP, NREP, KRF, NRF, NVEHKL
COMMON JTARGET TVEL, HVEHCL, DISRVH, ITGITP, IMUTS, ITGIPS
COMMON JINE/ DUELDS, IIMHOW, TOF, TBP, TIMPA, TIMPAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       STOP ! IN LOSCHK: EPROP WITH PANDOM OCCURRENCE OPTION !
                                                                                                                                                                                                                                                                                                                                                                                                                                 RIIGHOW=AMAX1(0.0.DTRNG-TVEL*TIMRA)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                               (PHGNOW.LE.PHGPLS(I)) GO TO 120
                                                                                                                                                                                                                                                                                KTEST(12,KRF)=KTEST(12,KRF)+1
IF (IRNDGC,EQ.1) GO TO 100
IF (TIMRA-LF,DURLOS) GO TO 130
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   PRIV=1.-(1.-PRLUS) ** XIIV
RN18=URAH31(IR18)
IF (RH18.LE.PRIV) GN TN 130
                                                                                                                                                                                                                                                                                                                                                           CALL ABRITL (JABPI)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             IABRT=12
CALL ABRTTL (IABRT)
                                           SUBROUTINE LOSCHK
                                                                                                                                                                                                                                                                                                                                                                                                                                                              DO 110 I*1, NPLOSE
                                                                                                                                                                                                                                                                                                                                                                                                                    XNV = NVEHCL -NVEHKL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     PREUS=PRELMS(I)
                                                                                                                                                                                                                                                                                                                                                                                      60 TO 130
                                                                                                                                                                                                                                                                                                                                            1 A B R T = 12
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            110 CONTINUE
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                                                                                                                                                                                                                                                                                                                                                                                                                    100
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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CM+RANGE 3
CM+RANGE 3
CM+RAPLCINZ
CM+TIME 2
SR-MINTRI1
SP-MINTRI2
SP-MINTRI4
SR-MINTRI4
SR-MINTRI7
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
SR-MINTRI8
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SR-MINTR32
SR-MINTR33
SR-MINTR34
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SR-MINTR36
SP-MINTR37
SR-MINTR38
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SR-MINIR40
SR-MINIR41
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SR-MINTR27
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SR-MINTR29
                                                                                                                                                                                                                                                                                                                                                             SR-MINTR24
SR-MINTR25
                                     SR-MINTRNZ
SR-MINTRN3
CM+HIT 2
                                                                                                                                                                                                                                                                                                                                                                                                                                   SR-MINTR30
                                                                                                           CM+RANDOM2
CM+RANDOM3
                                                                                                                                   CM+RANDOM4
                                                                                               CM+KTEST
                                                                                                                                               CM+RANGE
                                                                          CM+HIT
CM+HIT
                                                                                                                                              0000680
0000590
0001000
001020
001020
0023640
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023920
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023820
023830
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023850
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023880
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023540
000410
000420
000430
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                                                                                                        000440
                                                           COMMON /HIT/ INDFX(6,5,2), PETBL(60,10,7), DLTT(6), PKTBL(10,2), 1 HPNGTT, RHGTTF(20), TTF(3,20,2), HPNGPS, PHGPST(10), PSTTRL(10,2,3)
                                                                                                                                                                                                                                                                                                                                                               DG 120 J=1,3
PSTVAL(J)=PSTTBL(IFH,J)+TFRAC*(PSTTBL(IRN+1,J)-PSTTBL(IPN,J))
120 CONTINUE
                                                                                                                                                                                                                                                                        DO 100 IJ=1,NRNGFS
IF (RNGNOW.LI.RRGPSI(IJ).OR.RNGPSI(IJ+1).LE.PNGNOW) GO TO 100
                                                                                                                                                                 REAL HXDRNG
COMMON /RPLCTN/ KREP, HREP, KPT, HRF, NVEHKL
COMMON /TARGET/ TVEL, HVEHCL, DISRUH, ITGITP, IMUTS, ITGIPS
COMMON /IIMF/ DURLOS, ITHNOW, TOF, TBR, TIMRA, TIMRAL
                                                                                                                                                                                                                                                                                                                                                  110 TFRAC=(RNGNNW-PHGPST(IPH))/(PHGPST(IPN+1)-RNGPST(IRN))
                                                                                                                                                                                                                                                                                                                             STOP * IN MINTRH: FAILED TO BRACKET RANGE
                                                                                                                                                                                                                                                                                                                                                                                                                                       ITGTPS=0
IF (PSTVAL(1).LE.PN19) ITGTPS=1
IF (PSTVAL(2)+PSTVAL(1).LE.PN19) ITGTPS=2
                                                                                                                                                                                                                                               RNGNUW=AMAX1(0.0,0)DTRNG-TVEL*TIMRA)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     KTEST(16,KRF)=KTEST(16,KRF)+1
IF (ITGTPS,NE.0) GO TO 130
                                                                                                      COMMON /KTEST/ KTEST(20,6)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    CALL ABRITL (IABRI)
                                                                                                                                                                                                                           DIMFNSION PSTVAL(3)
                                                                                                                                                                                                                                                                                                                                                                                                                               RN19=URAN31(IR19)
                                             SUBPRINTINE MINTEN
                                                                                                                                                                                                                                                                                                             60 TO 110
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             IABRT=16
                                                                                                                                                                                                                                                                                                                         100 CONTINUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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000000000111111111222222222333333334444444444	23456789	98888888889 01234567890	COLUMN NUMBERS (READ VERTICALLY)
SUBROUTINE HOREC	023940	SP-NOREC 2	
The state of the s	023950	SR-NOREC 3	
Control / ICDDE / ICDDE	000450	CM+ICODE 2	
TOOL TOTAL	023970	SP-NOREC 5	
# TIE (O)TO) TOUR	023980	SPNOREC 6	
	023990	SR-NOREC 7	
CALL SIRALE	024000	SR-NOREC 8	
	024010	SR-NOREC 9	
STAR THE MAKES ATTEMPTED TO READ HIGH-EXISTERIT RECORD .	024050	SR-NOREC 10	
ن د	024030	SR-NOREC11	
	024040	SR-NOREC12	
* * * WINDER OF TOTAL STANDS S	024050	SR-NOREC13	
	024060	SR-NOREC 14	
TO THE STATE OF THE STATE THE STATE THE FEAT RECORD NAMED , A10, 30H BUT 024070	024070	SP-NOREC15	
I THO SUCH RECORD MAS FILLIND	024080	SR-NOREC16	
	05 40 40	SR-NOREC17	
000000000111111112222222223333333334444444444	7777777777777	8888888889 01234567890	COLUMN NUMBERS (READ VERTICALLY)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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SR-OUTPU34
SR-OUTPU35
SR-OUTPU36
SR-OUTPU37
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SR-OUTPU42
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SR-DUTPU50
                                                                                                                                  CM+RUNDATZ
CM+SCCSS Z
SR-DUTPU12
SR-OUTPU13
                                                                                                                                                                                                                       SR-OUTPU17
SR-OUTPU18
SP-OUTPU19
SR-OUTPU20
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SR-DUTPU27
SR-DUTPU28
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SR-OUTPU32
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SP-OUTPUTZ
SR-OUTPUT3
CM+ABORT 2
CM+ABRLBL2
CM+DODF 2
CM+DODF 3
                                                                                                                                                                                  SR-OUTPU14
SR-OUTPU15
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SR-OUTPU24
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1PU26
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                                                                         CM+FLAG 2
CM+FLAG 3
CM+FLAG 4
CM+KTEST 2
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                                                                                                                         CM+RPLCTN2
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024510
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          NKILL(J) HYEST(19, J)-HARORT(19, J)
IF (RHOREC(J), NE, FLOAT(HKILL(J))) WPITE (6, 300) J, PHORFC(J), NKILL(024589
IF (RHOREC(J), NE, FLOAT(HKILL(J)))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         024610
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024480
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                                                                                                                                                                                                                                     024270
                                                                                                                          000770
                            COMMON /ABRLBL/ IDABRI(3,19)
COMMON /ABRLBL/ IDABRI(3,19)
LOGICAL DOMILD
LOGICAL DOMILD
LOGICAL DOMILD
LOGICAL DOMILD
LOGICAL DOMILD
LOGICAL DOMILD
LOGICAL DOMILD
                                                                                                                                                                                                                                                                                                                                             ABRPCT(I,J)=-1.0
If (HREP.NE.O) ABRPCT(I,J)=100.*FLOAT(NARORT(I,J))/FLOAT(MP.FP)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                   DO 140 I=1,19
IF (HTEST(1,1),EQ.0) PASPCT(1,1)=1.0
IF (HTEST(1,1),HF.0) PASPCT(1,1)=100.*(1,-FLOAT(NARORT(1,1)))
1 /FLOAT(HTEST(1,1)))
                                                                                                 LOGICAL ENDELG, ENDREP
COMMON / KTEST/ KTEST(20,6)
COMMON / KTEST/ KTEST(20,6)
COMMON / PRLCTN / KREP, MRFP, KRE, INCFFG, IPPFG
COMMON / PUNDAT/ DAT, TIM, HCASE, ICCPFG, IPPFG
COMMON / SCCSS/ RNDFEC(6)
DIHENSION HKILL(6), DUT(6)
DIHENSION PREPCT(20,6), HTEST(20,6), PASPCT(20,6)
DIHENSION PREMCT(6), PPRKAT(6), PRRKS(6)
                                                                                                                                                                                                                                                                                                                                                                                                        NTEST(1,J)=NREP
DO 130 I=2,19
NTEST(I,J)=NTEST(I-1,J)-NABORT(I-1,J)
COHTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                [ATENG=NTEST(8,1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             ISHUT=NTEST(12,1)
        SUBRIQUEINE OUTPUT
                                                                                                                                                                                                                                          NKILL(J) = 0

(UT(J) = 0.0

DT 100 I=1,20

NTEST(I,J) = 0

C C INTINUE
                                                                                                                                                                                                                                                                                                                              DO 120 I=1,19
DO 120 J=1,6
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    DO 160 J=1,6
                                                                                                                                                                                                                                                                                                                                                                                                       DO 150 J=1,6
                                                                                                                                                                                                                                00 110 3=1,6
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     I OCSN=NP.EP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   160 CONTINUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

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SR-0UTPU53
SR-0UTPU54
SR-0UTPU55
SR-0UTPU56
SR-0UTPU57
SR-0UTPU57
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SR-OUTPU60
SR-OUTPU61
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SR-OUTPU73
SR-OUTPU74
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SR-OUTPUB3
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SR-OUTPU66
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SR-OUTPU77
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SR-OUTPU81
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SR-OUTPU88
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SR-0UTP104
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SR-DUTP100
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SR-DUTPIO2
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Y=PASPCT(I_J)
YOUT=FPRCHT(Y, TPUF.)
WRITE (6,340) I,(IDARRT(K,I),K=1,3),MABOPT(I,1),XOUT,NTEST(I,1),
                                                                                                                                                                IF (IOCSH.NE.O) PPBKB(J)=100.*FLDAT(NKILL(J))/FLDAT(IDCSN)
IF (IATENG.NF.O) PPBKAE(J)=100.*FLDAT(NKILL(J))/FLDAT(IATENG)
IF (ISHUT.NE.O) PPBKS(J)=100.*FLDAT(NKILL(J))/FLDAT(ISHUT)
                                                                                                                                                                                                                                                                                                          PEBSAE==1.0
PRDAED==1.0
IF (IOCSN.NE.0) PRBSD=100.*FLDAT(ISHOT)/FLDAT(IOCSN)
IF (IATENG.NE.0) PRBSAE=100.*FLDAT(ISHOT)/FLDAT(IATENG)
IF (IOCSN.NE.0) PRBAED=100.*FLDAT(IATENG)/FLDAT(IOCSN)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 PRDOKC=-1.0

IF (RREP.NE.O) PROMKL=100.*FLGAT(NDOKIL)/FLOAT(NREP)

IF (NTEST(14,1).NE.0) PRDOKC=100.*(1.-FLGAT(NDOKIL)

/FLOAT(NTEST(14,1)))
                                                                                                                                                                                                                                                                                                                                                                                                                                                     DO 180 J=1,6
PRHLOS(J)=PASPCT(11,J)*PASPCT(12,J)/100.
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           IF (I.Eq.7) WRITE (6,390) IATENG IF (I.Eq.11) WRITE (6,400) ISHNT CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   X=ABPPCT(I,1)
XOUT=FPECNT(X, TEUF.)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        WRITE (6,320)
WRITE (6,330) IBCSN
                                                                          DU 170 J=1,6
PRBKU(J)=-1.0
PRBKAE(J)=-1.0
PRBKS(J)=-1.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DA 210 I=1,11
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           WP.ITE (6,350)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             PROUKL =-1.0
                                                                                                                                                                                                                                                                                       PRBSO=-1.0
                                                                                                                                                                                                                                            CONTINUE
                                                                                                                                                                                                                                          170
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 60 OF 82)

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COLUMN NUMBERS (READ VERTICALLY)
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SR-OUTP124
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SR-0UTP160
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SR-0UTP117
SR-0UTP118
SR-DUTP108
SR-DUTP109
SR-DUTP110
SP-DUTP111
                                                      SR-0UTP113
SR-0UTP114
SR-0UTP115
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SR-00TP120
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                                              WRITE (6,360) IS(IDABRT(K,1),K=1,3),(NABORT(I,J),OUT(J),J=1,NRF)
DO 230 J=1,NRF
X=PASPCT(I,J)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         XOUT=FPRCHT(PRDGKL).TRUE.)
YOUT=FPRCHT(PRDGKC, TRUE.)
WRITE (6,460) HORKIL,XOUT;NTEST(14,1),YOUT
                                                                                        DUT(1)=FPECHT(X, TRUE.)
CONTINUE
WRITE (6,370) (HTEST(I,J), NUT(J),J=1,NPF)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   STATFMENTS
                                                                                                                                                  WRITE (6,380) (NKILL(J),J=1,NRF)
                                                                                                                                                                                                                                                                                                                                                                                                               WRITE (6,450) (DUT(3), J=1, NEF)
                                                                                                                                                                                                                                                                                                                                                WPITE (6,430) (NUT(J), J=1, NRF)
                                                                                                                                                                                                                                                                                 WRITE (6,420) (MIT(3), J=1, NPE)
                                                                                                                                                                                                                  WRITE (6,410) (OUT(I), I=1, NRF)
                                                                                                                                                                                                                                                                                                                                                                                                                                     XNUT=FPRCNI(PRBSA, FALSE.)
YOUT=FPRCHI(PRBSAE, FALSE.)
ZOUT=FPRCHI(PRBAEO, FALSE.)
WRITE (6,440) XNUT,YOUT,ZOUT
       DD 240 I=12,19
Dn 220 J-1,4RF
X=ABRPCT(1,J)
DUT(J)=FRCNT(X,TPUE.)
                                                                                                                                                                                                                                               X=PRBKAE(J)
DUT(J)=FPRCMT(X, FALSF.)
CONTINUE
                                                                                                                                                                                                                                                                                                                       X=PRBKS(J)

DUT(J)=FPRCNT(X, FALSE.)

CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                           OUT(J)=FPRCNT(X, FALSE.)
                                                                                                                                                                                               GUT(J)=FPRCNT(X,.FALSE.)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        * FOPMAT
                                                                                                                                                                                                                                                                                                                                                                        DO 280 J-1, NRF
                                                                                                                                                                                                                                                                                                          DO 270 J=1,NRF
                                                                                                                                                                                                                                          DG 260 J=1, NRF
                                                                                                                                                                           J=1,NRF
                                                                                                                                                                                                                                                                                                                                                                                     X = PR.HL OS (J)
                                                                                                                                                                                    X=PRBKO(J)
                                                                                                                                                                                                           C NNT INUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         RETURN
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 61 OF 82)

COLUMN NUMBERS	VELACE TO VER I LEALE TO																
78888888889	SR-0UTP161	SR-0UTP162 SR-0UTP163	SR-OUTP164 SR-OUTP165	SR-0UTP166 SR-0UTP167	SR-001P168	SR-GUTP170	SR-OUTP171	SR-00TP173	SP-DUTP174	SR-001P176	SR-OUTP177	SR-001P178	SR-DUTP180	SR-001P181	SR-OUTP183	SR-DUTP185	SR-OUTP187
000000001111111112222222222333333344444445555556666666667777777778888888888	290 FORMAT (56H SERIOUS PROBLEM ! KTEST AND HTEST ARRAYS DO HOT AGREE025700	5,9H P.NDREC=,F5.0,8H NK		330 FORMAT (50%,511*****)IX-10HOCCASIONS *1H(,15,1H),6H *****) 025750 240 FORMAT (111 ,/,1H ,77,3X,3A,10,17,1H, A,7 50, 50, 50, 50, 50, 50, 50, 50, 50, 50,	1ED): 17-11(-47)	4X,1H2,14X,1H3,14X,1H4,1	360 FORMAT (1H 3/31H 3/233X 3A10,6(17,1H(,A7)) 025800		390 FORMAT (IH)/945X,5H******1X,23HATTEMPTED ENGAGEMENTS (*15,7H) ***025830	(1H s/s53%s6H***** .7HSHTT / TE 2HZ	(1H) / 98x, 30HPROB (XIL/OCSN)= .1x_6(A10_6x)	,1X,6(440 FORMAT (8X;16HPROB(SHOT/OCSM)=,1X;410,8X;20HPDR(SHOT/ATMP FNG)= 1025890	450 FORMAT (8%, 20110000 / 1011) - 11/5/A10)	460 FORMAT (111 -/ JIM A SHIDESTGHATOR SURVIVABILITY: CASES IN WHICH DESIGNS930 IGNATOR KILLED - 15 111 42 5 30 000000000000000000000000000000000	2) IH(5A7) ** ISOZSOGNIUMBEP TESTED (% NOT KILLED) ** ISOZSOGO END	096520

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 62 Of 82)

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SP-PECHK39
                                                                                                                                                                                                                                                              CM+RSPTIM5
CM+TARGET2
CM+TIME 2
CM+WEATHR2
                                                                                                                                                                                                                                                                                                                                                    SP-PECHK14
SR-PECHK15
SR-PECHK16
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SP-PECHK 41
SP-PECHK 42
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                                                                                                                                             CM+RANDOM3
CM+RANDOM4
                                                                                                                 CM+KTEST 2
CM+RANDOM2
                                                                                                                                                                                                       CM+RPLCINZ
CM+RSPTIM2
                                                                                                                                                                                                                                                                                                                                       CM+WEATHR4
                                                                                                                                                                                                                                     CM+RSPTIM3
                                                                                                                                                                                                                                                   CM+RSPTIM4
                                                                                                                                                                                                                                                                                                                           CM+WEATHR3
                                                                                                                                                                            CM+RANGE
                            CM+FLAG
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                                                                                                                                                                                                    COMMON / RPPCTN/ KREP, HREP, KRE, HRF, NVEHKL
COMMON / RSPITH/ BATRIH(3), XHVADE(2), DUMI, BCSPIM(2,2), XHTIIM(2,000790
COMMON / RSPITH/ BATRIH(3), XHVADE(2), DUMI, BCSPIM(2,2), XHTIIM(2,000790
1 2), THEAN(2,2), TSIGAA(2,2), DETTHA(10,2), BTARY(3,2), 000810
2 PRSPTH, PRBAR, PRSOT, PRSOT, ALPHA(2,2), BTARY(2,2), DETTIM, 000810
2 DISSTP, RUMG, PRENC, PROM
COMMON / TIME DUMEUS, THNUM, TGF, TBM, TIMEA, TIMEA, 001000
COMMON / TIME DUMEUS, THNUM, TGF, TBM, THRAI
COMMON / WARTIN, PRCLCS, PRCFES(2), PRGCEL(11,2), W(6,11,2), 001060
COMMON / WESUM(2), MCFSUM(2), ICC, IVL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  026220
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                                            000310
                            COMMON /FLAG/ ENDREP, IDN/ IPREPL, IDIGTL, IPPTY, IPNDOC, IT3FLG,
                                                                                                                                                                                                                                                                                                                                                                                                                                   IF (IPREPL.EQ.1.AND.IT3FLG.FQ.1) T3=TRBAR+DETTIM-RUMC/TVEL
DELTAT=T1+T2+T3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                IF RNGK<1, IRNG1=IRHG2=1; IF RNGK>7, IPHG1=IPNG2=7.
DTHERNISE, IRNG1 <= PNGK < IRHG2.
IPHG1 AND IRNG2 WILL BE USED IN INTERPOLATING IN PETBL.
                                                                                                                                                                                                                                                                                                                                                                                                 T1=FLDAT(KRF-1)*TBR-FLOAT(NVEHCL-1)*DISBVH/TVE1
T2*TINRA1-DETTIM-TPBAR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    IF (RNGK.LT.1.0.0R.1RNG1.F9.7) IRNG2=IRNG1
IF=AMAX1(RNGK-FLDAT(IRNG1).0.0)
IF (FF.6.9.0) GN TO 100
IF=IF/(FLDAT(IRNG2)-FLDAT(IRNG1))
IF (INUTS.HE.2) GD TD 110
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      FIND IPHGI AND IRNG2 WHICH BRACKET RHCK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                             IF (DELTAT.LE.0.0) DELTAT=0.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          II=IMDEX(ICC,IDELTT,IMUTS)
IVLA=MIMO(IVL,IO)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         IF (DELTAT.LE.O.O) IMUTS=2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              IRNG1=MIN1 (RNGK, 7.0)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          IRNG1=MAXO(1, IRNG1)
IRNG2=IRNG1+1
                                                                                                                                                                                                                                                                                                                                                                            RNGK = RNG NOW / 1000.
    SUBPRUTINE PECHK
                                                                                                                                                                                              REAL MXDRMG
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                IDELTI=1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               I MUTS=1
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 63 OF 82)

123470/870123456/870123456/890123456/89012345678901234567890123456/890123456/890123456/890123456	123456789	01234567890	(READ VERTICALLY)
PE1*PETBL(IIsIVLAsIPNGI)	026400	SR-PECHK44	
PE-PEI+TF*(PF2-PF1)	026410	SR-PECHK 45	
60 TU 140	026420	SR-PECHK46	
	054920	SK-PECHK47	
C BRACKET DELTAT WITH DLTT VALUES CORRESPONDING TO IDELT1 AND IDELT2	026440	SR-PECHK49	
-	056460	SR-PECHK 50	
IF (DELTAT.LT.DLTT(1).PR.DFLTAT.GF.DITT(1+11) GN TN 120	026470	SR-PECHK51	
IDELT:	026480	OK-PECHK52	
IDELTZ=I+1	026500	SR-PECHK54	
120 CONTIMIE	026510	SR-PECHK55	
	026520	SR-PECHK56	
	026530	SR-PECHK58	
	026550	SR-PECHK59	
C PULNIS FUR EACH UP THU DELAY TIME VALUES.	026560	SR-PECHK60	
730 FDT=DELTAT=DITT(15511)	026570	SR-PECHK61	
FDT2*FDT/(DLTT(IDELT1))	026580	SP-PECHK62	
FDT1=1.0-FDT2	056930	SP - PECHK63	
TF2=TF	026600	SR-FECHKOS	
1F 1= 1=0-1F2	026620	SR-PECHK 66	
11 = INDEX(ICC, IDEL T1, IMUTS)	026630	SR-PECHK67	
TAC THORN TO US THE ICE INTO STATE INTO STATE IN TAIL TALK	056640	SR-PECHK 68	
PETIPI=DETRI (TT1-TV) A. TRWA1	059920	SR-PECHK 69	
PETIP2=PETBL (11) - IVI A. IPIG2)	026660	SP-PECHK70	
PETZR1*PETBL(II2*IVA*IRNG1)	079970	SR-PECHK 71	
PET2R2=PETBL(II2,IVLA,IPNG2)	02660	SK-PECHK /2	
IF (IDELT2.EQ.6) PET2P1=0.0	05630	08-FECTIV 10	
IF (IDELTZ.EQ.6) PET2R2=0.0	026710	SP-PECHX 75	
PE=FDI1*TF1*T#TF2*PET1P1*TF2*PET1P2+FDT2*TF1*PF1*RF2*TF2*TF2*PF12R2026720	2026720	SR-PECHK76	
140 BN22=11DAN311TE	026730	SR-PECHK77	
X	026740	SP-PECHK 78	
IF (RNZZ-LE-PF) GH THISO	026750	SR-PECHK 79	
	026760	SR-PECHK80	
IABRT=17	02/200	SR-PECHKBI	
CALL ABRITL (IABRI)	026790	SK-PECHK82	
	026800	SR-PECHKR4	
150 RETUPH	026810	SR-PECHK85	
FILD	026820	SR-PECHK86	
00000000011111111122222222222333333334444444444	7777778	8888888889	COLUMN NUMBERS
31040107101010101010101010101010101010101	0.4000.000	068/964671	(READ VERLICALLY)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 64 OF 82)

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SR-PENAM51
SR-PENAM52
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SR-PENAM13
SP-PENAM14
SR-PENAM15
SR-PENAM16
SR-PENAM17
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SR-PENAM45
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                                                                CM+XVALUE2
SR-PENAME6
SR-PENAME7
                                                                                                SP.-PENAMEB
SR-PENAME9
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SR-PENAM27
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                                                                            026880
026890
                                                                                                                                                                                                                                                                                                                                                      IF (TR.LE.O.O.OR.TR.GE.ººº.5) STOP ' IN PENAMF: ERROR NUMRER 3 '
NCODE=TR+.50
                                  SUBROUTINE PENAME (TP, IDT, VEL, GTR, REFL, ANGLET, DEFB, TGTHD, SKSEN,
                                                                                                                                                                                                                                 DG 100 I=1,8
IF (ABS(AVALUE(1)-XVALUE(I,1,1)),GT..0001) GN TN 100
NP(1)=XVALUE(I,1,2)+.5
GD TD 110
                                                                                                                                                                                                                                                                                                                          (NP(J).GE.8) STOP * IN PENAME: EPROP NUMBEP
                                                                                                                                                                                                                                                                                   TOP * IN PENAME: ERROR NUMPER 1
                                                                     COMMON /XVALUE/ XVALUE(8,9,2)
DIMENSION AVALUE(9), HP(9)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             DECODE (10,1%0,IPCODE) NOOPE
                                                                                                                                                                                                                                                                                                                                                                                                                           ENCADE (10,170,IPCODE) ACADE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    DO 140 J=2,9
HP(11-J)=HOD(HCODF,8)
NCODE=NCODE/8
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                              DO 130 J=2,9
NCODE=8*NCODE+NP(J)
                                                                                                                                              AVALUE (4)=GTR

AVALUE (5)=RBF EL

AVALUE (6)=ANGLET

AVALUE (9)=TOTHD

AVALUE (9)=SKSEH
                                                                                                                AVALUE(1)=TR
AVALUE(2)=IDT
AVALUE(3)=VEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               ₽¶ 160 J=2,9
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           ENTRY PEIDNT
                                                                                                                                                                                                                                                                                                                      DO 120 J=2,9
                                                                                                                                                                                                                        DO 110 J=2,0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         NP (1) = NC ODE
                                                  1 IDCODE)
                                                                                                                                                                                                                                                                           CONT INUE
                                                                                                                                                                                                                                                                                                110 CONTINUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 65 OF 82)

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IF (ABS(FLOAT(NP(J))-XVALUF(T.1.2)).GTOOQ1) CD TD 1ED	027380	SR-PENAM56	
AVALUE (3) = XVALUE (1-1-3)	057390	SP-PENAM57	
60 10 160	057400	SR-PENAM58	
150 CONTINIE	027410	SR-PENAM59	
STOP & IN DENAME (DEIDNIE). Com nameto	027420	SP-PENAM60	
140 CONTINUE TABLE	027430	SR-PENAM61	
	057440	SR-PENAM62	
AVALUE (1) = NCIDE	057450	SR-PENAM63	
	05 7460	SP-PENAM64	
TP=AVALIFETT	027470	SR-PENAM65	
TO T = AVA 11 1 2 3	027480	SP-PENAM66	
VET = AVALUE (2.)	057490	SP-PENAM67	
GTD=AVACLOLO	027500	SP-PENAM68	
D T T T T T T T T T T T T T T T T T T T	027510	SR-PENAM69	
ANGLET - AVAILED A	027520	SR-PENAM70	
DEFENDATION TO THE TAIL	027530	SR-PENAM71	
TGTUDENTALON	027540	SR-PENAM72	
7	02750	SR-PENAM73	
COLUMN MEDICAL	027560	SP-PENAM74	
PETIEN	027570	SR-PENAM75	
	027580	SR-PENAM76	
	057590	SR-PENAM77	
C * * * TORMAT STATEMENTS * * *	027600	SP-PENAM 78	
	023620	SP-PENAMBO	
TRMAT	027530	SP-PENAMB1	
180 FORMAT (4X, P. 6)	027640	SP-PENAMB2	
END	027650	SR-PENAM83	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 66 OF 82)

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COLUMN NUMBERS (READ VERTICALLY)
00000000111111111222222333333334444444555555566666666677777777888888888 CDLUMN NUMBERS
123456789012345678001234567890123456789012345678901234567890123456789012345678901234567890 (READ VERTICALLY)
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                                                                                                                                                                                                                                                                                                                                     COMMON /KTEST/ KTEST(20,6)
COMMON /KANDOM/ IR1, IR2, IR3, IR4, IR5, IR6, IR7, IR8, IR9, IR10, 000490
COMMON /RANDOM/ IR1, IR2, IR14, IR15, IR16, IR17, IR18, IP19, IP20, IR21000650
2 , RR22, IR23, IR24, IR25, IR26, IR27, IP28
COMMON /RECTM/ KREP, NREP, KRF, NNEHKL
COMMON /SCCSS/ RNDREC(6)
COMMON /SCCSS/ RNDREC(6)
COMMON /TARGET/ TVEL, NVEHCL, DISBUN, ITGITP, IMUTS, ITGIPS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              027760
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                                                                                                                                                                                                                                                                                                       000430
                                                                                                                                                                                                          COMMON /HIT/ INDEX(6,5,2), PETBL(60,10,7), DLTI(6), PKTBL(10,2),
1 NRNGTT, RNGTTE(20), TTF(3,20,2), HRNGPS, RNGPST(10), PSTTBL(10,
2 3)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  PK=PKTBL(ITGTTP,ITGTPS)
RN21=URAN31(IR21)
KTEST(19,KRF)=KTEST(19,KRF)+1
IF (PM21,LE,PK) GN TO 100
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      RNDR EC (KRF) = RNDRFC (KRF)+1.0
NVEHKL = MINO(NVEHKL+1.NVEHCL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     IABRT=19
CALL ABRTTL (IABRT)
GO TO 110
                                                                                                                                           SUBROUTINE PKCHK
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 67 OF 82)

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UUUUUUUUIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	777777777777777777777777777777777777777	8888888889 01234567890	COLUMN NUMBERS (READ VERTICALLY)
SUBROUTINE PPLOT	027920	SR-PPI OT 2	
	027930	SR-PPLOT 3	
COMMON PRONDATA DATA TINA NCASE, ICCPEG, IPPEG	000840	CM+RUNDAT2	
	027950	SR-PPLOT 5	
LIMENSIM CN(IO)	05 79 60	SR-PPLOT 6	
	027970	SR-PPLOT 7	
CHULDE (100) TOOK (1) HUNSE, I PPEG	027980	SR-PPLOT 8	
CATION (CMPIC) ALSE,)	05 2 4 9 0	SR-PPLOT 9	
הם - סרב	028000	SR-PPLOT10	
	028010	SR-PPLOT11	
	02880	SR-PPLOT12	
* * * * * * * * * * * * * * * * * * *	028030	SR-PPLOT13	
The state of the s	028040	SR-PPLOT14	
TO THE PARTY OF THE PARTY OF PARTY OF THE CASE FIZE IN THE PRESENT OF THE PARTY OF	N028050	SR-PPLOT15	
The PLIN PRUDGES .)	058060	SR-PPLOT16	
	028020	SR-PPLOT17	
000000000111111111222222222223333333333	1234567890	388888889 31234567890	COLUMN NUMBERS (READ VERTICALLY)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 68 OF 82)

```
(READ VERTICALLY)
SR-PSMOKE2
SR-PSMOKE3
SR-PSMOKE4
CM+SMOKED2
CM+SMOKED2
CM+WEATHR2
CM+WEATHR3
CM+WEATHR4
SR-PSMOKE7
SR-PSMOKE7
SR-PSMOK10
SR-PSMOK13
SR-PSMOK13
SR-PSMOK13
SR-PSMOK13
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                                                                              COMMON /SMOKED/ SMK2(3,3,2), SMK5(3,3,2), FRONT, NSMK2, NSMK5,

1 PSMKKL
COMMON /WEATHR/ PRCLCG, PRFTLS(2), PRGCFL(11,2), W(6,11,2),

1 VIS(11), CLOUD(6), HCC, HVL, PASQL(6), WHDSPD(3,3), HUMID(2),

2 WSUM(2), WCFSUM(2), ICC, IVL
PSMKKL=0.0
                                                                                                                                                                                               DG 100 I=1,3
JEND=1
IF (I*EQ*2) JEHD=3
DG 100 J=1, JEND
DG 100 J=1, JEND
DG 100 K=1,2
VSHK=FLQAT(NSHK2)/SHK2(I,3,K)+FLGAT(HSHK5)/SHK5(I,3,K)
VSHK=FLQAT(LSHL1)/FRGUT, VSHK)
PSGGT=PASQL(2*I-1)+PASQL(2*I)
PSHKKL=PSHKKL+PASGT*WHDSPD(I,3)*HHMID(K)*VSHK
                                                                                                                                                                                                                                                                                                                                                                 PSMKKL * PSMKKL / FRONT
                                                    SURROUTINE PSHOKE
                                                                                                                                                                                                                                                                                                                                  100 CONTINUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 69 OF 82)

_	SUBRUCHIME: REINTZ	028320	SR-REINTZ2	
	COMMON /ABORI/ NABORI(20,6), MSABLM	028330	SR-REINTZ3	
COMMON	COMMON /KTEST/ KTEST(20,6)	0004400	CM+KTEST 2	
COMMON		IR9, IR10,000640	CM+RANDOM2	
I IRIII	IP18, IR19,	IR20, IR21,000650	CM+RANDUM3	
7 1 6 7	# 1822 1823 1824 1825 1826 1827 1828	099000	CM+RANDOM4	
	CONTOUT ARTECIAL ERETS BREEZ REFY HREY NVEHKL	000220	CM+RPLCTN2	
		006000	CM+SCCSS 2	
DIMENSI	DIMENSION IR(28)	028400	SR-REINIZ9	
ن		028410	SR-REINT11	
EGUIVAL	EQUIVALENCE (IR(I), IRI)	028420	SR-REINT12	
	10 100 INTEST-1.20	028430	SR-REINT13	
DO 100	00 100 JKTEST=1*6	044870	SE-REINITA	
100 KTEST(I	KTEST(IKTEST, JKTEST)=0	02000	SETERINI LO	
00 120	00 120 Je1.NRE	004070	01 11 12 12 12 12 12 12 12 12 12 12 12 12	
RNDRFC(3)=0.0	J)=0.0	028480	SR-REINTIA	
DO 110 I=1,20	I=1,20	028490	SR-REINTIG	
	0=(f¢I	028500	SR-REINT 20	
110 CUNTINUE	<u></u>	028510	SR-REINT21	
TZO CONTINUE	<u></u>	028250	SR-REINT22	
		028530	SR-REINT23	
M=2++25		028540	SR-REINT24	
DO 130 T=1.28	T=1,28	00000	CZINIEZNYCO	
K=MDD(8*K,20)	**K*20)	028560	SR-REINIZ6	
IR(I)=2	IR(I)=2*(M*K/29)+1	028580	SP-REINIZ/	
130 CONTINUE	لنيا	028500	CD-DEINIO	
٥		028600	SR-REINT30	
IF (IPP	IF (IPPINT.EQ.0) WRITF (8,140) (IP(I),1=1,28)	028610	SR-REINT31	
IPRINT=I	ı	028620	SR-REINT32	
KETUKII		028630	SR-REINT33	
		028640	SR-REINT34	
* *	* * * * * * * * * * * * * * * * * * * *	028650	SR-REINT35	
-	* * 0	028660	SR-REINI36	
140	FORMAT (1H , 21HPANDOM NUMBER SEEDS : 1, (10110))	028670	SK-REINI37	
END		02820	SELVET NEW SO	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 70 OF 82)

SR-RNDREL2 SR-RNDREL3 CH+MISC 2 CH+RANDOM2 CH+RANDOM3 CH+RANDOM3 CH+RPLCINZ SR-RNDREL9 SR-RNDREL10 SR-RNDREL10 SR-RNDREL110 SR-RNDREL12 SR-RNDREL13 SR-RNDREL13 SR-RNDREL14 SR-RNDREL14 SR-RNDREL15 SR-RNDREL14 SR-RNDREL14 SR-RNDREL14 SR-RNDREL15 SR SUBROUTINE RNDREL

COMMON /KTEST / KTEST (20,6)

COMMON /FISC / DOADPRY, PELIF

1 PRIJ, PRIS, 100 RETUPM ں ပ

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 71 OF 82)

SURP DUITTHE BUGCHK	078900	SP-RNGCHK2	
	028910	SP-RNGCHK3	
COMMON /KTEST/ KTFST(20,6)	0000400	CM+KTEST 2	
COMMON /PANGE/ DIRHG, MXDRHG, VISLIM, RNGNOW	000080	CM+RANGE 2	
REAL MXDRNG	069000	CM+RANGE 3	
CONMON /RPLCTN/ KREP, NREP, KRF, NRF, NVEHKL	022000	CM+RPLCTN2	
ı	028950	SR-RNGCHK7	
KTEST(3, KRF) = KTEST(3, KRF) + 1	028960	SP-RNGCHK8	
IT (PTRMG.LE.MXPRMG) GO TO 100	028970	SR-RNGCHK9	
U	028980	SR-RNGCH10	
IABRT=3	028990	SR-RNGCH11	
CALL ABRITL (IABRI)	059000	SR-RNGCH12	
U	029010	SR-RNGCH13	
100 RETURN	029020	SR-RNGCH14	
U	029030	SP-RNGCH15	
END	029040	SR-RNGCH16	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 72 OF 82)

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SR-SEPREC3
CM+C 100FLG3
CM+L 100FLG3
CM+L 100FLG3
CM+SYMB0L2
CM+SYMB0L2
CM+SYMB0L2
CM+SYMB0L2
CM+SYMB0L2
CM+SYMB0L2
SR-SEPREL3
SR-SEPREL3
SR-SEPREL3
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029400
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029420
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029440
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029460
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029470
                        CONNON /COMENT/ CHENT(13,20), COMBUF(13), ICHNT, NTRC
COMMON /LOGFLG/ FIRSTL, SEQUINL, SPCL(70), SHRTEC, FTSILL
LOGICAL FIRSTL, SEQUINL, SPCL, SHPTEC, FTSILL
COMMON /SYNBOL/ BLANK, DECPNT, ALFBFT(27), ANUMBP(11), SEP(5),
DIMENSION A(N1), B(N2,N3), NCPR(10)
DIMENSION A(N1), B(N2,N3), NCPR(10)
DIMENSION CH(10)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ENCODE (120,350,CH(1))
CALL COMINT (CM.10,FALSE.,TRUE.)
ENCODE (120,360,CH(1))
CALL COMINT (CM.10,FALSE.,TRUE.)
GO TO 230
If (.HOT.SEQHML) on TO 250
      SUBROUTINE SEPREC (A,M1,B,N2,N3)
                                                                                                                                                                                                                                                                                                                                                                                                                                                            IF (*NOT.FIRSTL) 60 TO 220
FIRSTL=.FALSE.
DO 190 I=73.78
IF (NC'T) ...
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           IF (HC(I).NE.3) GU TO 250
CONTINUE
SEQNINE.TRUF.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      250
                                                                                                                                                                                                                                                                                                                                    DG 150 I=1,N1
NC(I)=IDCHAR(A,N1,I)
DG 170 I=1,N1
IF (NC(I),NE.5) GG TG 170
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      10
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                                                                                                                                                    DU 100 I=1,10
100 CNNIINUE
10 NC (I)=0
10 NC (I)=0
10 120 I=1,N2
120 8(1,3)=BLANK
130 PB(1,3)=BLANK
130 PB(1,3)=BLANK
130 PB(1,3)=BLANK
130 PB(1,3)=BLANK
130 PB(1,3)=BLANK
130 PB(1,3)=BLANK
140 NC PR (I)=0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                210 I=79,80
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         220 IF (.NDT.SEQNM)
230 DO 240 I=73,78
                                                                                                                                                                                                                                                                                                                                                                                                        J=1,10
                                                                                                                                                                                                                                                                                                                                                                            IF (NC(I).)
NC(I)=3
DU 160 J=1.
NC(I+J)=1
GO TO 180
CONTINUE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 73 OF 82)

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COLUMN NUMBERS (READ VERTICALLY)
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    350 FORMAT (92H YOU HAVE SEQUENCE NUMBERS IN COLUMNS 73-78 OF TAPES. 030050

1 THEY WILL BE REHINVED BY THE PROGRAM;)
360 FORMAT (91H HOWEVER, IF THE TEMPORAFY OPTION WAS USED TO PEAD IN A030080

1NY DATA, THE PESULIS MAY BE SUSPICET.)
0300000
370 FORMAT (80A1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     029900
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                                                                                                                                                                                                                                                                                                                                                                            GD TO 260
IF (NC(I).EQ.3.NP.NC(I).EQ.4.DR.IM.ME.IX) GO TO 290
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   *
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CONTINUE
DO 340 I=1,HRE
KCHAR=NCPR(I)
EHCNDE (80,370,B(1,1) )(PB(J,1),J=1,KCHAR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              STATENENTS
                                                                                                                                                                                                                                                                                                             260 IF (I.6T.NI) GO TO 320
IF (NC(I).NE.3.OP.IW.HE.IX) GO TO 280
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 IF (NPE.GE.O.AND.NRE.LE.10) GO TO 330 STOP ' IN SEPREC: ERRNR NUMPER 1 '
                                                                                                                                                                                                                                                                                                                                                                                                                                                              60 T0 310
IF (HC(I).NE.4) 60 T0 310
IF (I.NE.(LSTCMA+1)) 60 T0 300
                                                                                                                                                       SEPARATE RECORDS ON IMPUT CARD.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                60 TO 270
IF (MC(I).EQ.3) GO TO 270
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ENCODE RECORDS INTO B ARPAY
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   PB(J,IW)=A(I)
HCPR(IW)=HCPR(IW)+1
GD TG 270
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          *** FORMAT
                                                                NC(I)=3
240 CONTINUE
250 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                LSTCMA=I
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                           [W=IW+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               NPE- IV
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                                                                                                                                                                                                    I±1
IW=0
IX=0
                                                                                                                                                                                                                                                                   J=0
                                                                                                                                                                                                                                                                                                                                                          270
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(PAGE 74 OF 82)

LISTING D-1 FORTRAN LISTING OF

COPE PROGRAM - CONT'D

SR-SMOKE 3
CM+KATEST 2
CM+KANDOM3
CM+RANDOM3
CM+RANDOM4
CM+RANDOM4
CM+SMOKED3
CM+WEATHR9
CM+WEATHR9
CM+WEATHR9
CM+WEATHR9
CM+WEATHR9
SR-SMOKE10
SR-SMOKE11
SR-SMOKE12
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SR-SMOKE18 COMMON /KTEST/ KTEST(20,6)

COMMON /RANDAW IR1, IR2, IR3, IR4, IR5, IR6, IR7, IR8, IR9, IR10,000640

COMMON /RANDAW IR1, IR25, IR23, IR4, IR16, IR17, IR18, IR19, IR10,000650

A 1R22, IR23, IR23, IR25, IR25, IR26, IR26, IR26, IR26, IR2000650

COMMON /RANDKED/ SMK2(3,3,2), SMK5(3,3,2), FROHT, NSMK2, NSMK5, 000770

COMMON /SMOKED/ SMK2(3,3,2), SMK5(3,3,2), FROHT, NSMK2, NSMK5, 000920

COMMON /ARTHR/ PRCLC6, PRCFLS(2), PRGCFL(11,2), W(6,11,2), 001070

COMMON /WATHR/ PRCLC6, PRCFLS(2), PRGCFL(11,2), W(6,11,2), 001070

CM+W

VIS(11), CLOUD(6), NCC, NVL, PASOL(6), WNDSPD(3,3), HUMID(2), 001070

CM+W

Z WSUN(2), WCFSUM(2), ICC, IVL

CRANDAM / WATHR/ COMMON / WATHR/ COMM 030260 030280 030130 030140 000490 030300 IABRT=5 CALL ABRTTL (IABRT) SUBROUTINE SMOKE 100 RETURN END Ų ں

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 75 0F 82)

SUBPRINTINE SMPLCD (A.NDI.ND2.NRS.NDR.IRNDM.XSMPL.ICLASSI	, XSMPL, ICLASS)	036980	SR-SMPLCDZ	
		030330	SR-SMPLC03	
DIMENSION ACHDI, ND2)		030340	SR-SMPLCD4	
		030350	SR-SMPLCD5	
		030360	SR-SMPLCD6	
RM=IRAN31(TRNDM)		030370	SR-SMPLCD7	
TE (RM_1T_1_0) GO TO 100		030380	SR-SMPLCD8	
		030390	SR-SMPLC09	
CALL STRACE		030400	SR-SMPLC10	
STOP : IN SHPLCD: RAHDOM NUMBER THO LARGE	-	030410	SR-SMPLC11	
		030450	SR-SMPLC12	
100 CONTINUE		030430	SR-SMPLC13	
NDRM 1= NDR-1		030440	SR-SMPLC14	
DO 110 I=1, NORM1		030450	SR-SMPLC15	
IF (A(I,1), LE, RN, AND, RN, LT, A(I+1,1)) GO TO 120	120	030460	SR-SMPLC16	
110 CONTINUE		030470	SR-SMPLC17	
		030480	SR-SMPLC18	
CALL STRACE		030490	SR-SMPLC19	٠
STOP 1 IN SMPLCD: FAILED TO BRACKET RANDOM NUMBER	NUMBER '	030500	SR-SMPLC20	
		030510	SR-SMPLC21	
120 xsmp1=a(1,NRS)+(PN-A(1,1))*(A(1+1,NRS)-A(1,NRS))/(A(1+1,1)-A(1,1))	, NRS))/(A(I+1, 1)-A(1,1)	~	SR-SMPLC22	
ICLASS=I		~	SR-SMPLC23	
		030540	SR-SMPLC24	
RETURN		030220	SR-SMPLC25	
		030560	SR-SMPLC26	
		030570	SR-SMPLC27	
*** FORMAT STATEMENTS **	*	030580	SR-SMPLC28	
		030200	SP-SMPLC29	
130 FORMAT (1H ,59H IN SMPLCD WITH RANDOM NUMBER GREATER THAN 1.0,	ER GREATER THAN 1.0.	030600	SR-SMPLC30	
1 RN = +F10.7)		030610	SR-SMPLC31	
QNE		030620	SP-SMPLC32	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 76 OF 82)

COLUMN NUMBERS (READ VERTICALLY) SR-TIMCHKZ
SR-TIMCHK3
SR-TIMCHK3
CM+FLAG 2
CM+FLAG 4
CM+FTEST 2
CM+RPLCTNZ
CM+TIME 2
CM+TIME 2
SR-TIMCHIQ
SR-TIMCHIQ
SR-TIMCHI3
SR-TIMCHI3
SR-TIMCHI3
SR-TIMCHI3
SR-TIMCHI3
SR-TIMCHI3
SR-TIMCHI3 030640 030650 000300 000310 000320 000490 001070 030770 030710 030720 030740 030760 030760 COMMON /FLAG/ ENDREP, IDM, IPPEPL, IDIGTL, IPPIY, IRNOOC, IT3FLG,
LOGICAL ENDELG, ENDREP
COMMON KIEST/ KIEST(20,6)
COMMON /REST/ KIEST(20,6)
COMMON /REST/ KPEP, NPEP, RPF, NVEHKL
COMMON /RELCTN/ KPEP, NPEP, RPF, NTF, NYEHKL KTEST(11,KRF)=KTEST(11,KRF)+1 IF (TIMNOW-LT.DURLOS) 60 TO 100 IABPT=11 CALL ABRITL (IABRI) SUBROUTINE TINCHK 100 RETURN U ں

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 77 0F

82)

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COLUMN NUMBERS (READ VERTICALLY)
                                                            SR-TITLE 3
SR-TITLE 3
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CM+STITLE 5
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SR-TITLE51
SR-TITLE52
SR-TITLE53
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SR-TITLE32
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                                                                                                      CONHON /RUNDAT/ DAT, TIN, NCASE, ICCPFG, IPPFG
CONMON /STITLE/ SLVERS, VEPDAT(2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             STATEMENTS ***
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   WRITE (6,300) SLVERS, VERDAT(1), VERDAT(2)
WRITE (6,310)
WRITE (6,310) DAT, TIM
DO 140 I=1,5
                                                              SUBROUTINE TITLE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             * * * F O R M A T
                                                                                                                                                                         CALL DATE (DAT)
CALL TIME (TIM)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                WRITE (6,260)
WRITE (6,270)
WRITE (6,270)
WRITE (6,280)
WRITE (6,280)
WRITE (6,290)
WRITE (6,290)
DO 130 1=1,5
                                                                                                                                                                                                                                     WRITE (6,150)
WRITE (6,150)
DO 100 I=1,4
WRITE (6,170)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         WRITE (6,250)
DO 120 I=1,11
WRITE (6,170)
CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                         (6,190)
(6,170)
(6,170)
(6,170)
(6,170)
(6,220)
(6,220)
(6,230)
(6,230)
(6,230)
(6,230)
(6,230)
(6,230)
(6,230)
                                                                                                                                                                                                                                                                                                                                                                      DO 110 I=1,8
WRITE (6,170)
                                                                                                                                                                                                                                                                                                                                                    (6,180)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         WRITE (6,160)
                                                                                                                                                                                                                                                                                                                              CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 C NIT INUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                CONT INUE
                                                                                                                                                                                                                                                                                                                                                                                                                                         WWWRITTE
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LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 78 OF 82)

COLUMN NUMBERS (READ VERTICALLY)

SR-111LE56
SR-111LE57
SR-111LE59
SR-111LE60
SR-111LE60
SR-111LE64
SR-111LE64
SR-111LE67
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SR-111LE70 150 FORMAT (1H1)
160 FORMAT (1H) 13(10H**********)
170 FORMAT (1H , 1H*, 128x, 1H*)
180 FORMAT (1H , 1H*, 128x, 1H*)
180 FORMAT (1H , 1H*, 12x, 19HC O P E R H E A D O P E R A T I O N A LO31380
1 P E R F O R M A N C E E V A L U A T I O MAZOX, 1H*)
190 FORMAT (1H , 1H*, 32X, 29H-PROGRAM BY RICHARD SANDHEYER, 67X, 1H*)
21400
200 FORMAT (1H , 1H*, 32X, 29H-PROGRAM BY RICHARD SANDHEYER, 67X, 1H*)
21410
2154X, 1H*) 210 FORMAT (111 ,1114,34X,144DAVID BARNHAPT,8X,15HJULIAN CHEPHICK,5X,15H031440
1DIANA FREDERICK,37X,114)
220 FORMAT (111 ,114,34X,174RICHARD SANDHFYER,5X,15HRICHARD SCUNGID,5X,031460
114HNICHAEL STARKS,38X,114)
230 FORMAT (111 ,1114,34X,13HEDWARD STAUCH,9X,11HAHNTE YOUNG,61X,114+)
031470
240 FORMAT (111 ,1114,32X,38H-BASED ON A PROPOSAL BY HEPBERT FALLIN,58X,031490
031500 250 FORMAT (1H ,1H*,32X,48H-DONF AT THE REQUEST OF DAVID HARDISON (DUSGAISIO DA-DR),48X,114)

260 FORMAT (1H ,1H*,36X,53HUNITED STATES ARMY MATERIEL SYSTEMS ANALYSIO31530

15 ACTIVITY,30X,1H*) 270 FORMAT (IH 3114,51X,23HGROUND WARFARE DIVISION,54X,1H*) 031550 280 FORMAT (IH 3114,47X,31H5UPPRRT WEAPONS AMALYSIS BRANCH,50X,1H*) 031560 290 FORMAT (IH 3114,50X,26HSYSTEMS EVALUATION SECTION,52X,1H*) 031570 300 FORMAT (IH 3114,40X,13HCOPE VERSION ,F3,1,15H CURRENT AS OF ,2210,331580 137X,1H*) 310 FORMAT (1H ,1H*,42X,16HTHIS RUN DONE ON,A10,7HAT TIME,A10,43X,1H*)031600

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 79 OF 82)

0000000000111 123456789012	00000000011111111111222222233333333344444444555555556666666666	34567890 34567890	8888888889 1234567890	COLUMN NUMBERS (READ VERTICALLY)
SURROU	SURROUTINE USET	031630	SR-USET 2	
U		031640	SR-USET 3	
CUMMON		082000	CM+DVALUE2	
NDWWOO	COMMON /LOGFLG/ FIRSTL, SEQUNL, SPCL(70), SHRTEC, FTSILL	000200	CM+1.06FL62	
LOGICA	SPCL, SHRTEC, FTSILL	000520	CM+LOGFLG3	
NOMERON	J	095000	CM+OVER 2	
COMMON	COMMON TOVALUEL U(70), UPRT, UDT, UIDN, UIDIGT, USMK(2)	001040	CM+UVALUE2	
٠		031690	SR-USET B	
001 00	1,970	031700	SP-USET 9	
(1)0=(1)0		031710	SR-USET 10	
INVER(I)=0		031120	SR-USET 11	
	• F AL S F •	031730	SR-USET 12	
100 CUNIINUE		031740	SP-USET 13	
ב		031150	SR-USET 14	
UPRI=DPFI		031760	SR-USET 15	
100=100		031770	SR-USET 16	
NGIG=NGIO		031780	SR-USET 17	
UIDIGI III III III		031790	SR-USET 18	
USMK (1		031800	SP-USET 19	
USMK (Z	5)	031810	SR-USET 20	
LISILL	FISILL=.TRUE.	031820	SP-USET 21	
ر	0	031830	SR-USET 22	
RETURN	0	031840	SR-USET 23	
END	0	031850	SR-USET 24	
000000000111 123456789012	0000000001111111111222222222333333334444444444	7777778 84567890	8888888889 1234567890	COLUMN NUMBERS (Read Vertically)

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 80 OF 82)

0000000000 1234567890	00000000011111111112222222222333333334444444444	;55555556666666667777777777 ;345678901234567890123456789	8888888888 COLUMN NUMBERS 01234567890 (READ VERTICALLY)
SUB	SUBBOUTINE VISCHE	031870	031870 SR-VISCHK2
U		031880	SR-VISCHK3
COM	COMMON /KTEST/ KTEST(20,6)	065000	CM+KTEST 2
COM	COMMON /RANGE/ DIRNG, MXDRNG, VISLIM, RNGNOW	000680	CM+RANGE 2
REAL	REAL MXDRNG	069000	CM+RANGE 3
COM	COMMON /RPLCIN/ KREP, MREP, KRF, MRF, MVEHKL	022000	CM+RPLCTN2
ن		031920	SR-VISCHK7
KTE	KTEST(2,KRF)=KTEST(2,KRF)+1	031930	SPVISCHK8
II	IF (DTRNG.LF.1000.*VISLIM) GO TO 100	031940	SR-VISCHK9
U		031950	SR-VISCH10
IABE	ABRT=2	031960	SR-VISCH11
CALI	CALL ARRITL (IAREI)	031970	SR-VISCH12
U		031980	SR-VISCH13
100 RETUPN	NA.	031990	SR-VISCH14
U		032000	SP-VISCH15
END		032010	SPVISCH16
000000000000000000000000000000000000000	000000000111111111222222222233333333333	355555566666666667777777777777777777777	8888888889 COLUMN NUMBERS

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D

(PAGE 81 OF 82)

SUBROUTINE WARNDD		
032040 COMNON /FLAG/ ENDRED, IDN, IPREPI, IDIGII, IPRIY, IRNDAC, ITAFIG, OODAOO	+U SK-WARNDUB	
	_	
COMMON /KTEST/ KTEST(20,6)	90 CM+KTEST 2	
COMMON /FANDOM/ IR1, IR2, IR3, IR4, IR5, IR6, IR7, IR8, IR9, IR10,000640	Ŭ	
IP.18, IP.19, IR.20, IR.21	_	
	50 CM+RANDOM4	
COMMON JRPECTN/ KREP, MREP, KRF, NVEHKL	_	
COMMON /RSPIN/ BATRIN(3), XMVADF(2), DUM1, RCSPIN(2,2), XMTIIM(2,000790	O CM+RSPTIM2	
1 2) F TMEAN(2, 2), TSIGMA(2, 2), DETTHA(10, 2), NDT, TRARRY(3, 2), 000800	O CM+RSPIIM3	
2 PRSPTM, TRBAR, FRSDT, PRSVT, ALPHA(2,2), BETA(2,2), DETIIM, 000810	LO CM+RSPIIM4	
3 IDSGTP, RUMC, PCRMSG, PRDOW 000820		
COMMON /TIME/ DURLOS, TIMNOW, TOF, TBR, TIMPA, TIMRAI	20 CM+TIME 2	
KTEST(13,KRF)+1	20 SR-WARNDII	
IF (KRF.GT.1) GD TD 100 032130	٠.	
IF (RN16.LE.PRDOW) GO TO 100 032160	SO SR-WARND15	
	٠.	
CALL ABRITL (IABRI) 032190		
032200	O SR-WARND19	
100 RETURN 032210	LO SR-WARND20	
032520	20 SR-WARND21	
END 032230	30 SR-WARND22	

LISTING D-1 FORTRAN LISTING OF COPE PROGRAM - CONT'D (PAGE 82 OF 82)

FIRST CASE

```
$ THE NEXT CARD SIGNALS FORMATTED DATA IS TO BE READ INTO RANDOM
$ OCCURENCE DATA BLOCK
TEMP_RODIST
                                                                                                                                                  PLOT, PETHTER, OFF

$ THE QVERRIDE CARD WHICH FOLLOWS DVERLIDES THE NORMAL CHOICE OF

$ PE DATA WITH THE PE DATA RECORD MAMED PEODALAUS

$ NOTE THE USE OF THE $ BEFORE THE RECORD NAME

QVEPPIDE, PEDATA, $ PEODALAAJS
                                                                                                                                                                                                                                                                                                                                                                                                      1500.0 2000.0 3000.0 7000.0 .2 .2 .4 .3 .2 .2 .2 .4 .3 .1EADING PAGE
$$$ THIS COMMENT WILL APPEAR ON THE $$$ COMMENT PAGE WEATHER, JUNE, 0600
ACQRNGDIST, CLOSE
PLOT, PRINTER, OH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SMOKE, SMKRNDS, 200, 400
                                                                                                        DESIGTYPE, MULE
RESPTINE, PARAM, 150, N
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             NEXT CASE, RD
REFLECTIVITY, 3
SMOKE, PRESMOKE, 15
                                                                                                                                              CONTRUL, ECHO, LONG
                                                                                                                                                                                                                                                                                                                                                                                                                                                         TAPGET TYPE,4
DEIEESUPPP, NONE
RUNC, 200
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   PROBDOWAPN, . 8
                                                                                                                                                                                                                                                                   NEXT CASE, RD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                NUMVEHIGT.6
DISTRVFH.50
                                                                                            NEXT CASE, DR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      ANGLE Ty60
                                                                                                                                                                                                                                                                                                                                                                                                                             9.
8$ THIS (
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SAMPLE INPUT FOR COPE LISTING D-2

D-85

JUB CARD. CHANGE THIS CARD TO CONFORM TO INSTALLATION USAGE.

ACCOUNT CARD. CHANGE THIS CARD TO CONFORM TO INSTALLATION USAGE.

COMMENT. THE NEXT CARD DECLARES TARES TO HAVE RECORD TYPE Z AND 80 CHARACTEPS COMMENT. PER LINGTRECORD.

FILE, TARES, RI-Z, FL-80, 81-c.

COMMENT. THE NEXT STATEMENT OBTAINS A COPY OF THE COPE INPUT AND PUTS IT IN COMMENT. A LOCAL FILE NAMED TARES.

COMMENT. OFFEN A WISE PRECAUTION FOR CHECKING PURPOSES.

COMMENT. OFFEN A WISE PRECAUTION FOR CHECKING PURPOSES.

REWIND, TARES.

REWIND, TARES.

REWIND, TARES.

COMMENT. OBJECT CODE FOR THE COPE PROGRAM.

ATTACH, GO, COPESAMPLEBRIARY, 1D-SANDHEYER.

COMMENT. OBJECT CODE SANDHEYER.

ATTACH, GO, COPESAMPLEBRIARY, 1D-SANDHEYER.

COMMENT. HE NEXT STATEMENT ATTACHES THE COPE "DATA BASE" FILE (TAPEII) WHICH ATTACH, GO, COPESAMPLEBRIARY, 1D-SANDHEYER.

COMMENT. HE NEXT STATEMENT ATTACHES THE COPE "DATA BASE" FILE (TAPEII) WHICH ATTACH, THE NEXT STATEMENT ATTACH FOR THE COPE ROBY SATECHER THE COPE ROBY SATECHER THE NEXT TWO CARDS ATTACH.

COMMENT. THE HEXT TWO CARDS ATTACH THE INTERNATIONAL MATHEMATICAL AND COMMENT. THE HEXT TWO CARDS ATTACH.

COMMENT. STATISTICAL LIBRARY (IMSL) AND DECLARE IT TO RE A LIBRARY TO BE ATTACH, INC. ATTACH, INSL.

LIBRARY, INSL.

LIBRARY, INSL.

COMMENT: THE NEXT CARD DECLARES TAPEB TO HAVE RECORD TYPE Z AND 140 CHARACTERS

COMMENT: PER LIME. THIS IS DONE BECAUSE TAPEB IS TO BE SAVED ON THE "FRONT

COMMENT: END" COMPUTER WHERE RECORD TYPE Z IS THE DEFAULT RECORD TYPE.

COMMENT: THE NEXT STATEMENT LOADS AND EXECUTES THE COPE PROGRAM USING TAPES AS

SAMPLE RUNSTREAM FOR COPE LISTING D-3

COMMENT, IN LGO(TAPE5)

COMMENT. THE NEXT STATEMENT SAVES A CODY OF TAPER (COPE AUXILIARY OUTPUT)
COMMENT. ON THE "FRONT END" COMPUTER. THIS TAPER IS USED TO PRODUCE THE
COMMENT. LISTINGS OF SECTION 7.6 OF THE COPE DOCUMENTATION.
SAVEPE/ADER/COPEAUXOUTPUT/ID=SAUDMEYER/ST=MFA.

```
FIRST CASE

#$4$ THIS COMMENT WILL APPEAR ON THE $$$ COMMENT PAGF

#$ATHER, JUNE, D600

ACQRIEDIST_CLOST

PLOT, PRINTER, OH

RESTITIE, PARAH, 150,N

RESTITIE, PARAH, 150,N

CONTROL_ECHIPLATION

PRESTITIE, PARAH, 150,N

CONTROL_ECHIPLATION

PROT, PRINTER, OF

#$ THE OVERRIDE CARD WHICH FOLLOWS OVERRIDES THE NORMAL CHOICE OF

$$ THE OVERRIDE CARD WHICH FOLLOWS OVERRIDES THE NORMAL

CONTROL_ECHIPLATION

$$ THE OVERRIDE CARD WHICH FOLLOWS OVERRIDES THE NORMAL

SOUCHERING FOR THE $$ BEFORE THE PECORD HAME

BY DOT, PRINTER, OF

$$ NOTE THE USE OF THE $$ BEFORE THE PECORD HAME

BY DOTS CARD

WHO THE USE OF THE $$ BEFORE THE PECORD HAME

BY DOTS COMMENT WHILL BE PRINTED DATA IS TO BE READ INTO PANDOM

$$ THE NEXT CARD SIGNALS FORMATTED DATA IS TO BE READ INTO PANDOM

$$ THE RESURPENCE DATA BLOCK

I FARE TO SIGNALS FORMATTED DATA IS TO BE READ INTO PANDOM

$$ THE RESURPENCE DATA BLOCK

I FARE TO SIGNALS FORMATTED DATA IS TO BE READ INTO PANDOM

$$ THE RESURPENCE DATA BLOCK

I FARE TO SIGNALS FORMAT WHILL BE PRINTED DN CASE 3 HEADING PAGE

I FARE TO SIGNALS FORMAT WHILL BE PRINTED DN CASE 3 HEADING PAGE

I REPLIED FORMAT WHE

RUM, SOURCE PRESSIONES 15

BREELET IVITY, 3

SURVEY SOURCE PRESSIONES 15

BREELET IVITY, 3

SURVEY PRESSIONES 15

BREELET IVITY, 3

SURVEY PRESSIONES 15

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LISTING D-4 SAMPLE OUTPUT FROM COPE

(PAGE 1 OF 11)

EVALUATION PERFOPMANCE OFFRATIONAL COPPERNEAD

-PRICEAM BY RICHARD SANDNEYER

-MODEL DEVFLOPMENT AND DATA COLLECTION BY:

DIANA FREDFRICK JULIAN CHERNICK DAVID BARNHAPT

MICHAEL STARKS RICHARD SCUNGIO PICHARD SANDNEYER FNWARD STAUCH

-BASED ON A PROPOSAL BY HERBERT FALLIN

-DOME AT THE FEQUEST OF DAVID HARDISON (DUSA-OR)

UNITED STATES ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY

SUPPORT WEAPONS AHALYSIS RPANCH GROUND WARFAPF DIVISION

SYSTEMS EVALUATION SECTION

THIS RUM DONE ON OB/14/RO AT TIME 15.41.16. CHPE VERSION 6.2 CURPENT AS NF 6 MARCH 1980

LISTING D-4 SAMPLE OUTPUT FROM COPE

(PAGE 2 OF 11)

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** USFR ** THIS COMMENT WILL APPEAR ON THE \$\$\$ COMMENT PAGE

LISTING D-4 SAMPLE OUTPUT FROM COPE

(PAGE 3 OF 11)

************* NUMBER OF REPLICATIONS*10000

TARGET TARGET PLOSTECT COMMOD AND PROC THES PLOSTECT COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND COMMOD AND PROCESSION AND	化铁铁矿铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁铁	建筑中水水水水水水水水水水水水水水水水水水水水水水水水水水水水水水水水水水水水	计单数设计计划设计设计设计设计设计设计 法法律的法律的法律的法律的证据的证据的证据的证据的证据的证据的证据的证据的证据的证据的证据的证据的证据的
# PRIORITY PPE-PLANNED TARGET # DAY TIME # NOM THE # NOM	* TARGET *	* DETECT, COMMO, AND PROC TIMES *	* WEATHER
DEGREES		* PRIORITY PPE-PLANNED TARGET * * DIGITAL COMMO * * DAY TIME *	* # MONTH OF JUN * TIME OF DAY: 0600 *
Y= .10	* TARGET VELOCITY=3. M/SEC * * TARGET HEADING= 0. DEGREES *	* HUMINAL RESPONSE TIME=106. SEC * PPOB SUCCESSFUL PIGITAL TRAN= .915 *	*******
**************************************	* TARGET'S RFFLECTIVITY= .10 *	# PROB CORRECT MESSAGE = .975	***************************************
######################################	法操作法律 医水黄蕈素 法法律条件 化合物 医格拉特氏性神经性神经病性神经病性神经病性神经病性	***************************************	* TERRAIN AND LOS
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* TYPE 1 * 20. SEC * * INAXIMUM PESIGNATOR RANGE=7000. M * * * * * * * * * * * * * * * * * *	* WILLIAM OF BEHINDS OFF THE CHESTER	* DESIGNATOR *	安务公司公司公司公司公司公司公司公司公司公司公司公司公司公司公司公司公司公司公司
**************************************	POUND RELIABILITY 96 TIME BETWEEN ROUNDS * 20. SEC	* TYPE 1 ** * HAXIMUM DESIGNATOR RANCE=7000. H **	********************************
* * * * * * * * * * * * * * * * * * *		* BAIL-OUT PANGF=1000. M * DFSIGNATOP AT VANTAGE POINT *	* OBSCURANTS
**************************************		**************************************	* PROB SMOKE KILLS MISSION= .75 * VOLUME OF SMOKE FIRED: 484 + 846
**************************************	古女 李光雄春秋秋秋秋春春春春春春春春春春春春春春春春春春春春春春春春春春春春春春春 春春	·	* FRUR DOS! KILLS MISSION= .37
BE ZERO ** 60. JOULES/H**2 * *********************************	共享的不是否是不要的事实的,是不要的,并不是不要的,并不是不要的。	* DESIGNATOR SUPPRESSED *	解释的 化共享分类 计连接 化二甲基苯甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基
BE ZERO 60. JOULES/M**2 * *********************************		* PROB SUPPRESSED BY INDIRECT FIRE*.01 * * PROB SUPPRESSED BY DIRECT FIRE: HIGH *	
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LISTING D-4 SAMPLE OUTPUT FROM COPE

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COMMENTS

** COPE ** IN PPLOT FOR CASE 1 WITH IPPFG= 1 . HO PLOT PRODUCED .

(PAGE 4 OF 11)

CAUSE OF ABORT

													ø	345(3,45%) 702(50,85%)	0(0,00%) 357(100,0%)	144(1.44%) 357(59.66%)	13(0.13%) 213(93.90%)	
													řυ	242(2,42%) 702(65,53%)	0(0.002)	164(1.64%) 460(64.35%)	9(0.09%) 296(96.96%)	
	10000(99.16%)	9916(95.81%)	9501(100.02)	9501(100.02)	9501(25.03%)	2378(62,70%)	1491(67.54%)	**	1007(93.05%)	937(97.76%)	916(82.647)	757(92.73%)	4	151(1.51%) 702(78.49%)	0(0.00%) 551(100.0%)	183(1,837) 551(66,797)	16(0,16%) 368(95,65%)	
***** (000)	NUMBER TESTED (% PASSED):]	NUMBER TESTED (% PASSED):	NUMBER TESTED (% PASSED):	NUMBER TESTED (% PASSED):	NUMBER TESTED (% PASSED):	HUNBER TESTED (% PASSED):	NUMBER TESTED (% PASSED):	***** ATTEMPTED ENGAGEMENTS (1007) ****	NUMBER TESTED (% PASSED):	MUMBER TESTED (% PASSED):	HUMBEP TESTED (% PASSED):	NUMBER TESTED (% PASSED):	702) ****	96(0,962)	0(0.00%)	194(1.04%)	15(0.15%) 412(96.36%)	
**** DCCASIONS (10000) ****	NUMBER TESTED	NUMBER TESTEG	NUMBER TESTE	NUMBER TESTE	NUMBER TESTE	HUNBER TESTEL	NUMBER TESTER	ГЕМРТЕР ЕНGAGEMI	NUMBER TESTE	NUMBER TESTE	HUMBEP TESTE	NUMBER TESTE	***** SHOTS (702) *****	62(0.62%) 702(91.17%)	0(0.00%)	173(1,73%) 640(72,97%)	16(0.16%) 467(96.57%)	
****	84(0.84%)	415(4.155)	0(0.00%)	0(0.00%)	7123(71,23%)	887(8.87%)	484(4.84%)	TV ****	70 (0.70%)	21(0.21%)	159(1,59%)	55 (0.55%)	, H	30(0,30%) 702(95,73%)	15(0.15%) 672(97.77%)	176(1.76%) 657(73.21%)	20(0.20%) 481(95.84%)	
CAUSF OF ABORT	PESIGNATOP IN INDIRECT FIRE	TAPGET BEYOND VISIBILITY RANGE	TARGET REYOND DESIGNATOR RANGE	TARGET HOT DETECTED	SHOKE KILLER MISSION	PUST KILLTD MISSION	DESIGNATOR BAILFD-OUT PRF-COMM		COMMO DUT (BOTH VOICE & PIGTL)	FPROP IN TRANSMISSION	DESIGNATOP RAILED-OUT POST-COM	LOS LOST - NO FIRING	P DUND 'NUMBER':	LOS LOST DURING MISSION NUMBER TESTED (% PASSED)	DESIGNATOR NOT WARNED IN TIME NUMBER TESTED (* PASSED)	DESIGNATOP IN DIRECT FIRE NUMBER TESTED (\$ PASSED)	ROUND RELIABILITY FAILURE NUMBER TESTED (% PASSED)	
	-	>	er,	4	75	9	7		α	o	10	11		12	13	14	15	

LISTING D-4 SAMPLE OUTPUT FROM COPE (PAGE 5 OF 11)

DESIGNATOR SURVIVABILITY: CASES IN WHICH DESIGNATOR KILLED - 141(1.41%)

7.027

PROB(SHET/DCSN) =

PROB(KILL/OCSN)= PROB(KILL/ATMP ENG)= PROB(KILL/SHOT)= PROB(LOS)= NUMBER TESTED (% NOT KILLED) = 657(78,54%)

10.07%

PROBLATMP ENGINCSN)=

69.71%

28 ****

.58% 5.76% 8.26% 47.16%

102 1.02% 10.13% 14.53% 60.77%

> 1.137 11.227 16.107 72.797

1.327 13.117 18.807 80.055

1.457 1.477 14.405 14.607 20.667 80.442 80.777 PROB(SHUT/ATMP EHG)=

64(0.64%)

96(0.96%)

128(1.28%) 241(46.89%)

104(1.04%) 236(55.93%)

159(1.59%) 306(48.04%)

156 (1.567) 301 (48.172) 113

132

147

145

0(0.00%)

0(0.00%) 241(100.0%)

2(0.02%)

4(0.04%)

1(0.01%)

1(0.012)

29(0.29%)

46(0.46%)
287(83.97%)

55(0.55%) 352(84.38%)

83(0,837)

61(0,612) 451(86,472)

54(0.54%) 461(88.20%)

TARGET DBSCURED BY MINI-TERRN NUMBER TESTED (% PASSED)

16

49(0.49%)

43(0.43%) 241(82.16%)

54(0.54%) 295(81.69%)

74(0.74%)

83(0,83%) 389(78,66%)

105(1,05%)

ROUND ENGAGED BUT DID NOT HIT NUMBER TESTED (3 PASSED)

18

ROUND HIT BUT DID HOT KILL NUMBER TESTED (% PASSED)

19

***** KILLS

POUND DID NOT ENGAGE TARGET NUMBER TESTED (% PASSED)

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TARGET *	* DETECT, COMMO, AND PROC TIMES *	* WEATHER
TYPE 1 *** NUMBER DF VEHICLES=10 **	* * ARAMETEPIZED RESPONSE TIME=150. SEC * * * PRIORITY PRE-PLANNED TARGET *.	* * MONTH OF JUN * TIME OF DAY: 0600
* MFAN DISTANCE BETWEEN VEHICLES* 61.M * * TARGET VELNCITY=2. M/SEC	* DIGITAL COMMO * * NIGHT TIME	医电子氏虫虫 化非非常非常非常 医非合物 非非非常 的复数 计分离 化分离 计分离 计分离设计 计表示记录 计分离记录 计分离 化二甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基
* TARGET HEADING* 0. DFGREES *	* NOMINAL TESPONSE TIME=181. SEC	
Argel 2	* PROB SUCCESSFUL DIGITAL TRAN* .915 * * PROB CORRECT MESSAGE = .975 *	非种种的亦作 化拉拉拉拉拉拉拉 雅德洛洛 医格尔特 医水杨醇 医水杨醇 经未经帐款 的复数人名 化二甲基苯甲基甲基苯甲基苯基
法非法法法非法法法法法法法法法法法法法法法法法法法法法法法法法法法法法法	* PROB DO WARNED TO LASE = .975 *	* TERRAIN AND LOS
***************************************	**************************************	* * CLOSE TERRAIN
* * EIRING INFO	格拉特特格特法拉格特特格特特格特格特格特格特特特特格特格特特特特的法格沃特法格达科拉米特	<pre># CONTINUOUS LOS ("SHOOTING GALLERY") *</pre>
*	*	*****
* HUNBER UF ROUNDS PER ENGAGENENT= 6 - * * POHIND REFIABILITY≌ .96	* DESIGNATOR *	
TIME BETWEEN ROUNDS- 20. SEC *	* TYPE 2 *	化水平分子 计计算 化化化学 化化化学 化化化学 化化化化学 医电子 医电子 医电子 医电子 医电子 医电子 医电子 医电子 医电子 医电子
* TIME OF FLIGHT= 31.0 SEC ** ** MONINAL GHN-TAFGET BANGE= B. KM **	* MAXINUM DESIGNATOR RANGE=2600. M * * RATI OUT DANGE=1000 M	* OBSCURANTS
·	* DESIGNATOR AT VANTAGE POTINT *	* PROB CMOKE KILLS MISSION= .75
DEFLECTION BLAS= 0. METERS *	*	* VOLUME OF SMOKE FIRED: 484 + 846
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***	* DESTONATOR SUPPRESSED *	
WISC *	**************************************	
* * DFLTA T3 ASSUNED TO BE ZERO * SEEKER SENSITIVITY= 60. JOULES/M**2 *	* PROB SUPPRESSED BY INDIRECT FIRE=.01 * * PROB SUPPRESSED BY DIRECT FIRE: HIGH * *	
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CHOICE OF MIGHT TIME FOR RESPONSE TIME DATA IS INCOMSISTENT WITH TIME OF 0600 FOR WEATHER DATA RECORD NAMED: PEO0AJAAJS USED TO OVERRIDE FOR PEDATA PEDATA FOR: TR=106. DT=1 VEL=5. GTR= 8. REFL= .10 ANGLET= 25. DEFB= 0. TGTHD= 0. SKSEN=60.

LISTING D-4 SAMPLE OUTPUT FROM COPE

(PAGE 6 OF 11)

5] **** 21(0.21%)
138(84.78%) 2(0.02%) 265(2.65%) 428(38.08%) 66(0.66%) 0(0.00%) 18(0.18%) 158(88.61%) 163(96.93% 428(100.02) 5(0.05%) .51% 8.98% 0(0.00%) MUMBER TESTED (5 NOT KILLED) = 418 (55.982) 19(0.19%) 56(0.56%) 19(0.19%) 4(0.04%) 0(0.00%) 257(2.57%) 0(0.00%) 428(100.0%) .73% 12.85% 17.06% 0(0.00%) 100.02 PROBLATMP FNG/OCSN)= 2(0.02%) 30(0.30%) 23(0.23%) 75(0.75%) 228(2,28%) 428(46,73%) 200(96.50%) 0(0.00%) 428(100.02) 428(100.0%) 1122(50.62%) 568(93.13%) 529(97.35%) 515(83,11%) 7041(100.0%) 7041(25.38%) 1787(62.79%) 0(0.00%) 7(0.07%) NUMBER TESTED (% PASSED): 10000(99.16%) 9916(95.81%) LISTING D-4 SAMPLE OUTPUT FROM COPE **** ATTEMPTED ENGAGFMENTS (568) **** 24(0.24%) 173(86.13%) 210(2,10%) 428(50,93%) 8(0.08%) 37(0.37%) 210(82.38%) 0(0.00%) 0(0.00%) 88(0,88%) 149(40,94%) 0(0.00%) NUMBER TESTED (% PASSED): NUMBER TESTED (% PASSED): NUMBER TESTED (% PASSED): NUMBER TESTED (% PASSED): NUMBER TESTED (% PASSED): NUMBER TESTED (% PASSED): 10.74% 14.25% 100.0% NUMBER TESTED (% PASSED): NUMBER TESTED (% PASSED): NUMBER TESTED (% PASSED): NUMBER TESTED (% PASSED): ***** SHOTS (428) **** 19 (PAGE 7 OF 11) DESIGNATOR SURVIVABILITY: CASES IN WHICH DESIGNATOR KILLED = 184(1.842) 16.20% 14.61% 21.50% 19.39% 100.0% 100.0% PRUB(SHUT/ATHP EHG)= 1(0.01%) 82(0,82%) 165(50,30%) 33(0,33%) 31(0,31%) 0(0.00%) 0(0.00%) 0(0.09%) 189(1,89%) 428(55,84%) 83 36 (0,367) 206 (82,527) 78(0.78%) 2(0.02%) 27(0.27%) 235(88.51%) 10(0.105) 172(1,72%) 418(58.85%) 11(0,11%) 246(95,53%) 0(0.00%) 5254 (52.54%) 2460(24.60%) 87(0.87%) 0 (0.00%) 30(0.39%) 14(0.14%) 84(0.842) 415(4.15%) 0(0.00%) 665 (6.65%) 554 (5.547.) 20 -4.28% DESIGNATOR BAILED-DUT POST-COM ROUND ENGAGED BUT DID NOT HIT NUMBER TESTED (% PASSED) TARGET OBSCURED BY MINI-TERRH NUMBER TESTED (% PASSED) PESIGNATOR BAILED-OUT PRE-COMM COMMO DUT (ROTH VOICE & DIGTL) DESIGNATOR NOT WARNED IN TIME NUMBER TESTFD (% PASSED) TARGET BEYOND VISIBILITY RANGE TARGET BEYOND DESIGNATOR RANGE ROUND DID NOT ENGAGE TARGET NUMBER TESTED (% PASSED) EQUIND HIT BUT DID HOT KILL NUMBER TESTED (% PASSED) PESIGNATOR IN DIRECT FIRE NUMBER TESTED (% PASSED) ROUND RELIABILITY FAILURE NUMBER TESTED (% PASSED) LOS LOST DUPING MISSIGN NUMBER TESTED (% PASSED) DESIGNATOP IN INDIRECT FIRE PROB(KILL/DCSN) =
PROB(KILL/ATMP ENG) =
PROB(KILL/SHOT) =
PROB(LOS) =
PROB(LOS) **** KILLS EPPOR IN TRANSMISSION LOS LOST - NO FIRING SMOKE KILLED MISSION **DUST KILLED MISSION** TARGET NOT DETECTED ROUND NUMBER : 18 19 15 16 17 13 14 12 10 6 11

**** UCCASIONS (10000) ****

CAUSE OF ABORT

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NUMBER OF REPLICATIONS=10060

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* TARGET * *	* DETECT, COMMO, AND PROC TIMES *	* WEATHER *
* TYPE 4 * NUMBER OF VEHICLES = 6 * MEAN DISTANCE BETWEEN VEHICLES = 10.M *	* PRIORITY PPE-PLANNED TAPGET * * * DIGITAL COMMO * * A DAY TINE * * A DAY TINE * * A DAY TINE * * * A DAY TINE * * * A DAY TINE * * * A DAY TINE * * A DAY TINE * * * A DAY TINE * * * A DAY TINE * * * A DAY TINE * * * A DAY TINE * * A DAY TINE * * A DAY TINE * * A DAY TINE * * A DAY TINE * * A DAY TINE * * A DAY TINE * A DAY TIN	* MONTH OF DEC * * TIME OF DAY: 2200 * *
* TARGET VELOCITY=3, M/SEC * TARGET HEADING= 0, DEGREES *	* HOMINAL RESPONSE TIME*106, SEC * * * PROB SHOCKERSELL PLANS OF *	**************************************
* TAFGET*S REFLECTIVITY= .10 *	* PROB CORRECT MESSAGE = .075 * * PROB CORRECT MESSAGE = .075 * * PROB ON WARNED TO LAKE = .075 *	*************************
法操作诉讼者经济法院经济法院经济法院经验证证法院经济法院经验证证证证证证证证证证证证证证证证证证证证证证证证证证证证证证证证证证证证	经存储存储 化二甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基	* TERRAIN AND LOS *
**************************************	· ************************************	* AVERAGE TERRAIN * BROKEN LOS ("RANDOM OCCURRENCE") *
* * NUMBER OF POINDS PER FNGAGEMENT= 6 *	* DESIGNATOP *	*******************
* ROUND RELIABILITY= .96 * TINE BETWEEN ROUNDS= 10. SEC * TIME OF FLIGHT= 31.0 SEC *	* TYPE 1 * * MAXINUM DESIGNATOP RANGE=7000. M * * RAIL-QUT PANGE=1000. M * *	* * * * * * * * * * * * * * * * * * *
* NOMITAL GUN-TARGET RANGE * 8. KM * * * 4 MGLE TE. 25. DEGREES * * PETLECTION BIAS O. METERS * *	* DFSIGNATOR AT VANTAGE POINT **	
. 2	***	* VULUME UF SMUKE FIRED: 200 + 400 * * PROB PUST KILLS MISSION= .37 * *
***************************************	* * DESIGNATOR SUPPRESSED *	************************
* MISC * * DELTA 13 NOT ASSUMED ZERO *	* PROB SUPPRESSED BY INDIRECT FIRE*.01 * * PROB SUPPPESSED BY DIRECT FIRE: NONE * *	
* FUNCE 200.M * SFEKEP SFNSITIVITY= 60. JOULES/M**2 * * * *****************************	经接受方式 法未受法 的家庭 法法法法 化苯丙基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲	
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THIS COMMENT WILL BE PRINTED ON CASE 3 HEADING PAGE CHOICE OF DAY TIME FOR RESPONSE TIME DATA IS INCONSISTENT WITH TIME OF 2200 FOR WEATHER DATA TEMPORARY OPTION IN EFFECT FOR RODATA LISTING D-4 SAMPLE OUTPUT FROM COPE (PAGE 8 OF 11)

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(PAGE 9 OF 11)

													\$	785(7.85%) 2845(72.41%)	0(0.00%)	0(0.00%) 2060(100.0%)	80(0.80%) 2060(96.12%)	327(3,27%) 1980(83,48%)	242(2,42%) 1653(85,36%)	345(3,45%) 1411(75,55%)	226(2,26%) 1066(78,80%)	840 ****	8.40% 24.43% 29.53% 72.41%	2254(100.0%)
													īv	715(7,15%) 2845(74,87%)	0(0.00%)	0(0.00%)	87(0.87%) 2130(95.92%)	317(3,17%) 2043(84,48%)	209(2.09%) 1726(87.89%)	387(3.87%) 1517(74.49%)	217(2.17%) 1130(80.80%)	913	9.13% 26.56% 32.09% 74.87% ICSN) = 34.38%	(% NOT KILLED) = 2
	10000(99.16%)	9916(83.45%)	8275(100.02)	8275(100.0%)	8275(77.61%)	6422(62.69%)	4026(85.397)	***	3438(92,06%)	3165(97.38%)	3082(92.31%)	2845(100.0%)	4	660(6.60%) 2845(76.80%)	0(0.00%) 2185(100.0%)	0(0,00%) 2185(100,0%)	85(0.85%) 2185(96.11%)	351(3.51%) 2100(83.29%)	184(1.84%) 1749(89.48%)	367(3,67%) 1565(76,55%)	224(2,24%) 1198(81,30%)	426	9.74% 28.33% 34.24% 76.80% PPOB(ATMP ENC/OCSN)	TESTED
(10000) ****	(% PASSED):	D (% PASSED):	D (% PASSED):	n (% PASSED):	n (Z PASSED):	D (% PASSED):	D (% PASSED):	5 (3438)	ED (% PASSED):	ED (% PASSED):	ED (% PASSED):	ED (% PASSED):	2845) *****	600(6.00%) 2845(78.91%)	0(0.00%)	0(0.00%) 2245(100.0%)	89(0.897) 2245(96.045)	384(3.84%) 2156(82.19%)	180(1.80%) 1772(89.84%)	414(4.14%)	228(2,28%) 1178(80,65%)	050	9.50% 27.63% 33.39% 78.91% 82.75%	OUTPUT FROM COPE
OCC AS IONS	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	ATTEMPTED ENGAGEMENT	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	HUMBER TESTED	***** SHOTS (3	562(5,62%)	0(0.00%) 2283(100.0%)	0(0.00%)	75(0,75%)	382(3,82%) 2208(82,70%)	166(1,66%) 1826(90,91%)	428(4.28%)	265(2,65%) 1232(78,49%)	296	9.67% 28.13% 33.99% 80.25% I/ATMP ENG)=	KILLED = -
** *	84(0.847)	1641(16.41%)	0(0.00%)	0(0,005)	1853(18.53%)	2396(23.96%)	588(5,88%)	***** VI	273 (2.73%)	83(0.83%)	237(2.37%)	0(0.00%)	H	531(5.31%) 2845(81.34%)	60(0.60%)	0(0.00%)	92(0,92%)	376(3.76%) 2162(82.61%)	124(1.24%) 1786(03.06%)	424(4.24%) 1662(74.49%)	228(2,28%) 1238(81,58%)	1010	10.10% 29.38% 35.50% 81.34% PROB(SHOT/ATMP	╺믁
CAUSE OF ABORT	DESIGNATHR IN INDIRECT FIRE	TARGET REYOND VISIBILITY RANGE	TAPGET BEYOND DESIGNATOR RANGE	TARGET NOT DETECTED	SMOKE KILLED MISSION	PUST KILLED MISSION	DESIGNATOR BAILED-OUT PRE-COMM		COMMO OUT (ROTH VOICE & DIGTL)	ERROR IN TRANSMISSION	DESIGNATOR BAILED-OUT POST-COM	LOS LOST - NO FIRING	R OKATO TILIMB EP :	LOS LOST DURING MISSION NUMBER TESTED (% PASSED)	DESIGNATOR HOT WARNED IN TIME NUMBER TESTED (% PASSED)		COUND RELIABILITY FAILURE NUMBER TESTED (% PASSED)	TARGET UBSCURED BY MINI-TERRN NUMBER TESTED (% PASSED)	EDUND DID NOT ENGAGE TARGET NUMBER TESTED (% PASSED)	POUND ENGAGED BUT DID NOT HIT NUMBER TESTED (% PASSED)	ROUND HIT BUT DID NOT KILL NUMBER TESTED (% PASSED)	***** KILL S	PROB(KILL/DCSN) = PROB(KILL/ATMP ENG) = PROB(KILL/SHMT) = PROB(LOSN) = 28.45%	Υ: CΑ
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LISTING D-4 SAMPLE OUTPUT FROM COPE

(PAGE 10 OF 11)

(PAGE 11 OF 11)

												9	2679(26.79%) 3665(26.90%)	0(0.00%) 986(100.0%)	219(2,19%) 986(77,79%)	26(0.26%) 767(96.61%)	137(1,37%) 741(81,51%)	8(0.08%) 604(98.68%)	158(1.58%) 596(73.49%)	202(2,02%) 438(53,88%)	236 ****	2.36% 4.14% 4.14% 5.44% 2.48% 8% 2484(90.30%)
												ŗ.	2388(23.88%) 3665(34.84%)	0(0.00%) 1277(100.0%)	280(2,80%) 1277(78,07%)	31(0,31%) 997(96,89%)	154(1.54%) 966(84.06%)	5(0.05%) 812(99.38%)	211(2,11%) 807(73,85%)	280(2,80%) 596(53,02%)	316	3.16% 5.55% 8.62% 28.28% = 56.9
10000(99.16%)	9916(98.83%)	9800(100.0%)	9800(97.27%)	9532(84.89%)	8092(79.78%)	6456(88.26%)	**	5698(91.682)	5224(97.13%)	5074(89.00%)	4516(81.162)	4	2008(20.08%) 3665(45.21%)	0(0.00%)	318(3,18%) 1657(80,81%)	58(0,58%) 1339(95,67%)	218(2.18%) 1281(82.98%)	1063(99.53%)	261(2,61%) 1058(75,33%)	384(3.84%) 797(51.82%)	413	4.135 7.25% 11.27% 36.69% PRUB(ATMP EHG/DCSN) NUMBER TESTED (% NOT
(Z PASSED)	D (% PASSED):	en (% PASSED):	ED (Z PASSED):	ED (% PASSED):	ED (% PASSED):	ED (% PASSED):	(8695)	ED (% PASSED):	EP (% PASSED):	ED (% PASSED):	EP (% PASSED):	3665} *****	1529(15.29%) 3665(58.28%)	0(0.00%) 2136(100.0%)	357(3.57%) 2136(83.29%)	82(0,82%) 1779(95,39%)	303(3.03%) 1697(82.14%)	6(0,06%) 1394(99,57%)	399(3,99%)	504(5.04%)	485	4.85% 8.51% 13.23% 47.30% 64.32% 64.32% NI EDOM (
	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	NUMBER TESTED	HUMPEP TESTED	ATTEMPTED FNGAGEMENTS	HUMBER TESTED	MUMBEP TESTED	NUNBER TESTED	NUMBER TESTED	***** SHOTS (1058(10.58%) 3665(71.13%)	0(0.00%)	385(3,85%) 2607(85,23%)	75(0.75%)	392(3,92%)	6(0.06%)	502(5.02%) 1749(71.30%)	626(6.26%) 1247(49.80%)	621	6.213 10.902 16.943 57.733 /ATMP FMG)= KJULFD =
84(0.84%)	116(1.167)	0(0.00%)	268 (2, 687.)	1440(14.40%)	1636(16,36%)	758(7,58%)	*****	474 (4.74)	150(1,50%)	558 (5.587)	851(8,51%)	1	583(5.83%) 3665(84.09%)	598(5.98%)	303(3.037) 2484(87.807)	99(0,99%)	358(3,58%) 2082(82,80%)	7(0.07%)	503(5.037) 1717(70.70%)	636(6,36%)	578	5.78% 10.147 15.77% 68.25% PPGR (SINT/ATMP WHICH DESIGNATUR KILLE
DESIGNATOR IN INDIRECT FIRE	TAPGET BEYOND VISIBILITY RANGE	TARGET BEYOND DESIGNATOR RANGE	TARGET NOT DETECTED	SHOKE KILLEP MISSION	PUST KILLEP MISSION	DESIGNATOR BAILED-OUT PRE-COMM		COMMO OUT (BOTH VOICE & DIGTL)	EFROR IN TRANSHISSION	DESIGNATOR BAILED-DUT POST-COM	LOS LOST - NO FIRING	P DUND NUMBER :	LOS LOST DURING MISSION NUMBER TESTED (% PASSED)	DESIGNATOR NOT WARNED IN TIME NUMBER TESTED (% PASSED)	DESIGNATOR IN DIRECT FIRE NUMBER TESTED (% PASSED)	ROUND RELIABILITY FAILURE NUMBER TESTED (% PASSED)	TARGET OBSCURED BY MINI-TERRN NUMBER TESTED (% PASSED)	ROUND DID HOT ENGAGE TARGET NUMBER TESTED (% PASSED)	POUND ENGAGED BUT DID NOT HIT NUMBER TESTED (% PASSED)	RUUND HIT BUT DID NOT KILL NUMBER TESTFD (% PASSED)	***** KILLS	PROB(KILL/OCSN)= PROB(KILL/ATIP EHG)= PROB(KILL/SHOT)= PROB(LOS)= PROB(LOS)= 36.65% DESIGNATOP SUPVIVAPILITY: CASES IN W
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APPENDIX E

NOTATIONAL CONVENTIONS

In chapters 4, 5, and 14 of this report, the content of input cards is sometimes displayed with underlining. This underlining serves only to distinguish that which goes on the card itself from the remainder of the text; no actual underlining is punched on any of the input cards themselves.

Items which are displayed in capital letters (with underlining) in the description of a card type are to be copied literally, letter-for-letter onto the input card of that type. Items displayed in lower case letters represent positions on the card at which substitutions are to be made either from a list of allowed alternatives listed (in capital letters) in the descriptive text or by supplying an appropriate numerical value. In the lists of character strings allowed as substitutions for option words, only the underlined (capital) characters are used.

Similary, in chapter 7 where various messages and error prints are described, the capitalized, underlined part is printed as shown (but without the underlining) whereas the lower case part describes or substitutes for text which may vary from occasion to occasion.

APPENDIX F

GLOSSARY OF ABBREVIATIONS

BCS Battery Computer System

CDC Control Data Corporation

COPE (1) Combat Operational Performance Evaluation

(2) COPPERHEAD Operational Performance Evaluation

DMD Digital Message Device

D.O., DO (1) Designator Operator

(2) DO as in FORTRAN DO-LOOP

DT II Development Test II

FDC Fire Direction Center

GLLD Ground Laser Location Designator

HE High Explosive

IMSL International Mathematical and Statistical Library

LDWSS Laser Designator Weapon System Simulation

LOS Line-of-Sight

LTD Laser Target Designator

MULE Modular Unit Laser Equipment

OT II Operational Test II

PAM Probability of Acquisition and Maneuver

PE Probability of (Seeker) Engagement

PRBLOS Probability of Line-of-Sight

PREPMS Preprocessor of Mass Storage File

TLE Target Location Error

USAFAS US Army Field Artillery School

BIBLIOGRAPHY

- 1. Amoruso, Michael, J., Tice F. DeYoung, Dennis D. Ladd, and Roger D. Schulz, <u>A Comprehensive Digital Flight Simulation of the Cannon Launched Guided Projectile</u>, Rodman Laboratory, Rock Island, IL, January 1977, R-TR-77-007, UNCLASSIFIED report. This report documents a flight simulation model that serves much the same purpose as the LDWSS model. This work was not used in PAM or COPE, but may be of interest to the researcher in this field.
- 2. Chernick, Julian A., Moving Target Location Errors for Ground Targets, US Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD, September 1980, (to be published). This report contains an updated version of the target location error modeling of moving targets used in PAM and COPE.
- 3. Chernick, Julian A., Preliminary Analysis of Extended Range COPPERHEAD Operational Performance (U), Ground Warfare Division Interim Note No. G-85, US Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD, January 1980, CONFIDENTIAL report. This report analyzes the performance of extended range COPPERHEAD using one of the COPE variants (RPVCOPE).
- 4. Chernick, Julian A., Richard C. Scungio, Michael Starks, <u>Utility of COPPERHEAD with Ground Laser Designation in a European Battlefield Environment</u> (U), Technical Report No. 257, US Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD, December 1978, CONFIDENTIAL report.

 This report includes the first efforts to model the effects of weather on COPPERHEAD performance. It contains an analysis of the utility of COPPERHEAD under European weather conditions using particular terrain scenarios.
- 5. Control Data Corporation, FORTRAN Extended Version 4 Reference Manual, Revision E, CDC Publication No. 60497800, CDC, Publications and Graphics Division, Sunnyvale, CA, July 1979.

 This publication documents the version of FORTRAN IV in which the COPE program and its preprocessors are written. It is of special value to anyone attempting to modify COPE for use on any non-CDC machines.
- 6. Lewis, C.L., A.G. Nichols, and A.W. Lee, <u>User's Guide for the Phase I Laser Designator/Weapon System Simulation (LDWSS) of the COPPERHEAD Guided Projectile System</u>, Vol. I, Technical Report RG-77-25, US Army Missile Command, Redstone Arsenal, AL, July 1977, UNCLASSIFIED report. This report documents the LDWSS model which was used to generate the probability of hit (given secker engages target and round can maneuver to target) numbers used with COPE.

- 7. Starks, Michael, A Monte Carlo Model for Determining COPPERHEAD Probability of Acquisition and Maneuver (U), US Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD, September 1980 (to be published). This report documents the PAM program and the modeling assumptions underlying it in much greater detail than Chapter 16 of the present report.
- 8. Cost and Operational Effectiveness Analysis (COPPERHEAD COEA) (U), ACN 18812, US Army Field Artillery School, FT Sill, OK, October 1979, SECRET report.

 This report cites the sources of the data used with COPE, includes a section similar to Chapter 2 of the present report, and includes the analysis of COPE results. It also includes, of course, the entire COPPERHEAD COEA write-up.
- 9. Weaver, Jonathan M., and Lawrence Bowman, Multiple Target Simulation (MUTSI) A Discrete Monte Carlo Technique That Evaluates the Availability of Multiple Enemy Ground Targets in a GLLD/COPPERHEAD Target of Opportunity Situation, Ground Warfare Division Interim Note G-61, US Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD, July 1979, UNCLASSIFIED report. This report had some influence on the modeling of multi-vehicle targets in PAM and COPE.

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